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Kew. ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1889.

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1889.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 25.] JANUARY. [1889.

LXXVI.—COCA.

Erythroxylon Coca, Lamarck.

Erythroxylon Coca, var. *novo-granatense.*

In recent years the well-known Coca plant has received considerable attention owing in a great measure to the valuable properties which have been ascribed to one of its alkaloids called Cocaine as a local anæsthetic. Coca wine and various other preparations of Coca leaves are now also largely in use. The plant itself has been noticed and described by botanists and travellers for more than three hundred years.

The earliest detailed account appears to be that given by Nicholas Monardes in the third part of his "Historia medicinal de las cosas que "se traen de nuestras Indias Occidentales que serven en medicina," which was published at Seville in 1580 after the author's death. This was translated into Latin by Clusius while delayed by adverse winds at Gravesend on his way to Belgium, where the translation was

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published at Antwerp in 1582. In 1580 an English translation of the third part, in addition to that of the two earlier parts previously printed, was also published by John Frampton, a London merchant. The Kew Library possesses a copy of this book, which is printed in black letter; its title is "Joyfull newes out of the newe founde worlde, wherein is "declared the virtues of hearbes, trees, oyles, plantes and stones." A condensed translation from the Spanish of the three parts is given by Clusius in his "Exoticorum libri decem," 1605, which is usually quoted as the earliest authority on Coca.

The account given by Monardes of the Coca plant and its uses is tolerably minute. He describes the characteristic areolation of the leaf to be presently alluded to. He says, in the "Leafe there is "marked an other leafe of the lyke forme, with a line very thinne: "they are softe and of a light greene." He also describes the methods of using Coca when travelling, either in the form of balls of a paste made by chewing the leaves with lime made from shells, or the leaves alone. "For the use of these litle Balls taketh the hunger and "thirst from them: and they say that they receuive substance thereby, "as though they did eate meate. At other times they use them for "their pleasure, although they labour not by the way, and they use "the same *Coca* alone, chewing it and tossing it in their mouths, from "one side to another, until there be no vertue remaining in it, and "then they take another."

The Coca plant, although generally known for some time previously to European botanists, was first defined as a species according to modern principles of nomenclature by Lamarck in the Encyclopédie Méthodique (1786), from specimens brought from Peru by Joseph de Jussieu. Cavanilles figured and described it from the same specimens, and we have also a representation of it in the inedited plates of Ruiz and Pavon. The first figure of the Coca plant published in this country appeared in the *Companion to the Botanical Magazine* (1836), vol. ii., t. 21, with a description by Sir William Hooker, from specimens gathered by Mathews in the environs of Chinchao, Peru. A full account of the uses and property, mode of cultivation and commercial value of Coca in its native country had been given previously in the same work (p. 161), in a translation from the second volume of Dr. Poeppig's *Reise in Chili Peru, und auf dem Amazonenstrome.*

At that time and for many years afterwards Coca leaves were looked upon merely as the source of a stimulant to the nervous system, employed by the inhabitants of Peru and Bolivia in very much the same manner and for the same purpose as the Chinese use opium and the East Indians chew the betle. The published statements from Monardes onwards respecting Coca appear to establish the fact that its use by the Indians of the Andean region enabled them to accomplish such severe labour as no European could perform. Von Tschudi refers to the effect the use of Coca had on himself, in greatly assisting respiration and in enabling him to ascend high mountains without fatigue. Dr. Weddell, Spruce, and Markham, and numerous other travellers and scientific observers agree in ascribing to Coca marvellous sustaining power, although many of them are careful to point out that Coca used in excess produces highly injurious effects, like the immoderate consumption of other stimulants or narcotics.

According to De Candolle the original home of the Coca plant in South America has not been clearly defined.* He states that early authors, such as Joseph de Jussieu, Lamarck, and Cavanilles, had only seen cultivated specimens. The specimens gathered by Mathews in the ravine of Chinchao might have been beyond the limits of cultivation. Those from Cuchero, collected by Poeppig, were said to be wild, although the traveller himself was not convinced of this. "It is by no means improbable," he says, "that the seeds may have been dropped by birds." André speaks of Coca in the valley of the river Cauca in New Granada as "in abundance wild or half wild." On the other hand Triana, a reliable authority on such matters, does not admit that the species is wild in New Granada. At present we have the Coca cultivated to a very large extent in the Andes of the Argentine Republic, of Bolivia, Peru, Ecuador, and the United States of Columbia (New Granada). It is also cultivated in the mountainous parts of Brazil, and there are specimens in the Kew Herbarium from the head-waters of the Rio Negro collected by Spruce in 1854. The largest plantations, called locally *Cocals*, are said to be in the province of La Paz in Bolivia. Weddell estimates in a good harvest the produce of Coca leaves per acre at about 900 pounds. The total production of Coca is something like 40,000,000 pounds, worth at 1*s*. per pound a value of 2,000,000*l*. Almost the whole of the produce is consumed in South America.

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* *Origin of Cultivated Plants,* Eng. ed., 1884, p. 136.

As might naturally be expected with a plant that has been long under cultivation, there have arisen many points of difference between the Coca plants grown in different parts of South America. These points of difference have been produced no doubt by seminal variation, influenced by diversity of soil and climate. They do not, however, except in one instance, amount to more than is observed in what botanists are accustomed to call geographical forms. Poeppig remarks that the appearance of the plants cultivated in Peru and Bolivia varies considerably, the under side of the leaf in the Bolivian plant being of a yellowish colour. Planchon and Triana (*Prodomus Floræ Novo-granatensis*, p. 337) also discuss the various differences exhibited by Coca plants, and even raise the question whether some of them may not be specifically distinct.

From Lamarck's description—"feuilles ovales-pointues"—it is evident that he had before him the plant with oval leaves, acute at both ends, which is characteristic of the Peruvian form of the species.* This is figured by Cavanilles (Diss. t. 229), by Ruiz and Pavon, and more recently by Sir William Hooker. Both by priority of description and by the high esteem in which the leaf is held, this must be accepted as the type. Figure 1, p. 4, reduced from the plate in the *Companion to the Botanical Magazine*, represents this.

Erythroxylon Coca, Lamarck.—A shrub or small tree 2–5 feet high, erect and moderately branched; bark usually reddish brown, passing in older specimens into greyish brown; branches scarred where the leaves have fallen off; young twigs smooth. *Leaves* chiefly on upper branches, alternate, soon falling, one to three inches long, lanceolate or oval, sometimes attenuated into the petiole, but in the type more or less acute at both ends, apex mucronate, perfectly entire, dark green above, paler and glaucous beneath, quite glabrous, mid-rib prominent beneath, lateral veins numerous, faint, freely anastomosing, the areolated portion slightly concave, paler and extending from base to apex on each side of the mid-rib; petiole from $\frac{1}{4}$–$\frac{1}{3}$ inch long; stipules small, closely pressed to the stem, and united along their inner edge to form a single triangular, acute, toothed organ, intrapetiolar (placed between the petiole and the

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* Lamarck, Dict. ii., p. 393 (1786).

stem), very persistent, at first thin, greenish and transparent, becoming, on old branches, brown, stiff, and spinous. *Flowers* small, white, inodorous, on slender drooping glabrous pedicels, about $\frac{1}{4}$ inch long, several together in the axils of the leaves. *Calyx* very deeply cut into five triangular-ovate, acute, glabrous segments. *Petals* five, alternating with the calyx lobes, imbricate, with a broad claw, and a broadly oval-oblong, spreading, concave, obtuse limb, pale white or yellow, keeled at the back and somewhat plaited, with an erect, deeply bifid ligule at the junction of limb and claw, the two lobes crisped at the margin, with a reflexed tongue between them. *Stamens* 10, hypogynous, equal, as long or longer than the petals, erect, united at the base into a short fleshy tube surrounding the ovary; filaments white, smooth, anthers oblong, yellow. *Ovary* superior, ovoid, smooth, three-celled; styles three, erect, cylindrical, green, stigmas, capitate. *Fruit* a small indehiscent, red, smooth, drupe, one-celled, one-seeded by suppression, about $\frac{1}{2}$ inch long, oblong-ovoid, pointed, when dry, furrowed. Seed filling the endocarp, testa thin, embryo straight, with a superior radicle and flat cotyledons.

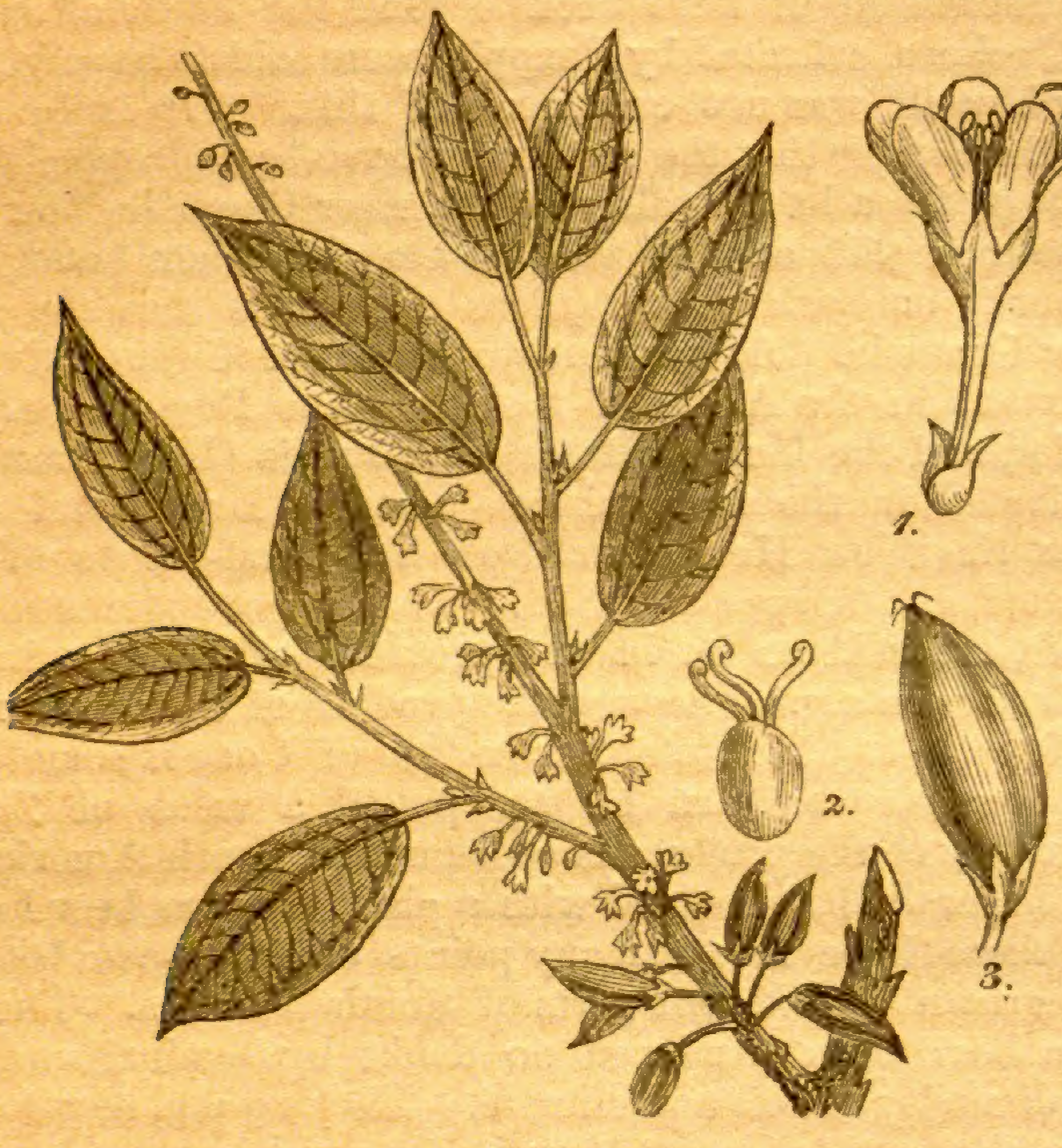

Fig. 1.

Erythroxylon Coca, Lamarck.

1. Flower. 2. Ovary and stigmas. 3. Fruit.

Other figures representing the type are given in Le Maout and Decaisne, *Botany,* (Hooker's translation), p. 295; and Baillon *Hist. des plantes,* pl. v., figs. 80–87.

Specimens representing this typical plant are in the Kew Herbarium from Mathews, No. 2023, collected at Chinchao, Peru; and from Mr. Pearce, collected also in Peru in 1867. A larger and bolder leaf than the type is found in a specimen collected by Mr. McLean in Peru, labelled "Coca from Titoc."

Leaves from specimens cultivated in Ceylon have lately been received from Dr. Trimen marked "from plants grown at an elevation of 1,500 feet;" also from specimens cultivated at the Botanical Gardens, Demerara, at sea level, from Mr. G. S. Jenman. A plant of this typical form is now under cultivation at the *Jardin des Plantes*, Paris. The leaves in all these become more or less dark green, and even brown in drying. One of the most marked characteristics of the Coca leaf is the areolated portion, bounded by two longitudinal arched lines on each side of the mid-rib. These lines or ridges, which are more conspicuous on the under surface of the leaf, are caused by folds or creases produced by the mode in which the leaves are folded in the bud. The areolated portion is slightly concave, that is, more sunk than the rest of the surface, and slightly differing in colour. This peculiarity is not, however, confined to Erythroxylon Coca. It is very marked in another species,—*E. areolatum*, Poepp., and it furnishes a character for the section *Areolata* of De Candolle's Prodromus, vol. i. p. 575, in which five species are included. In many other species, where there are no demarcating lines, the leaves are sometimes marked by similar bud plaiting, or have a peculiar colouring circumscribing the same area. Next to the typical Peruvian plant the most distinct form which has come under notice in this country in a living state is one which appears to be very similar to the specimens collected by Triana in the Vallee du Magdalena in 1851–1857, and by Purdie at Sta. Martha in 1845, both in New Granada.

These specimens are characterised by the pale green colour of the leaves, by their obovate shape, obtuse or even emarginate, and perhaps more by the diffuse branching and leafy habit of the plant. A form possessing these characteristics has been under cultivation at Kew for more than 20 years. It was raised from seed, for which Mr. Abraham Dixon, who presented it to Kew (in 1869), was indirectly indebted to the Bishop of Huanuco. From this plant there have been produced some hundreds of plants, which have been distributed to numerous correspondents in different parts of the world. In many British Colonies this is the only Coca plant under cultivation, and it is therefore of some importance to give as much information as possible respecting it. Agreeing as it does in general characters with the New Granada specimens, it may be distinguished as:—

Var. *novo-granatense:* a leafy bushy plant, bark greyish brown, branches numerous and somewhat spreading (not erect as in type). *Leaves* usually smaller, 2 inches long, 1 inch broad, crowded, membranous, bright green above, paler and glaucous beneath, obovate-lanceolate, narrowly attenuated into the petiole, apex rounded, often emarginate with a small apiculus in the notch.

Bentley and Trimen, Medicinal Plants, vol. i., pl. 40; *The Garden*, vol. ix. (1876), p. 445, with woodcut. By the kind permission of the editor, W. Robinson, Esq., F.L.S., this is reproduced as Fig. 2, p. 6.

Specimens of this are in the Kew Herbarium collected in New Granada by Purdie at Sta. Martha in 1845, and by Triana at the Vallee du Magdalena, 1851–1857. Specimens from cultivated plants have been received from Mr. W. Fawcett, Jamaica, grown at 600 feet; from Mr. W. B. Espeut, Spring Gardens, Jamaica, grown at 100 feet; from Mr. John Gray, grown at sea-level, at St. Lucia, and others very similar from the Agri-Horticultural Society of India. All the leaves mentioned above are light green in colour, which is well preserved in drying; they are generally smaller than the typical Peruvian leaves, and approach very nearly (although not so coriaceous) as what are known in commerce as Truxillo leaves.

Intermediate to the above, both as regards the form and size of the leaf, are specimens in the Kew Herbarium collected by Spruce in 1854 on the Rio Negro. Cultivated specimens exactly corresponding to these have been received from Dr. Treub, Buitenzorg Gardens, Java, grown at elevations of 820 feet, of 3,000 feet, and of 5,000 feet. Others very similar have also been received from the Gardens of the Agri-Horticultural Society of India at Alipore and from Mr. Sackville Cresswell, Darjeeling, Bengal. These leaves may provisionally be adopted as exhibiting the general characteristics of Bolivian Coca.

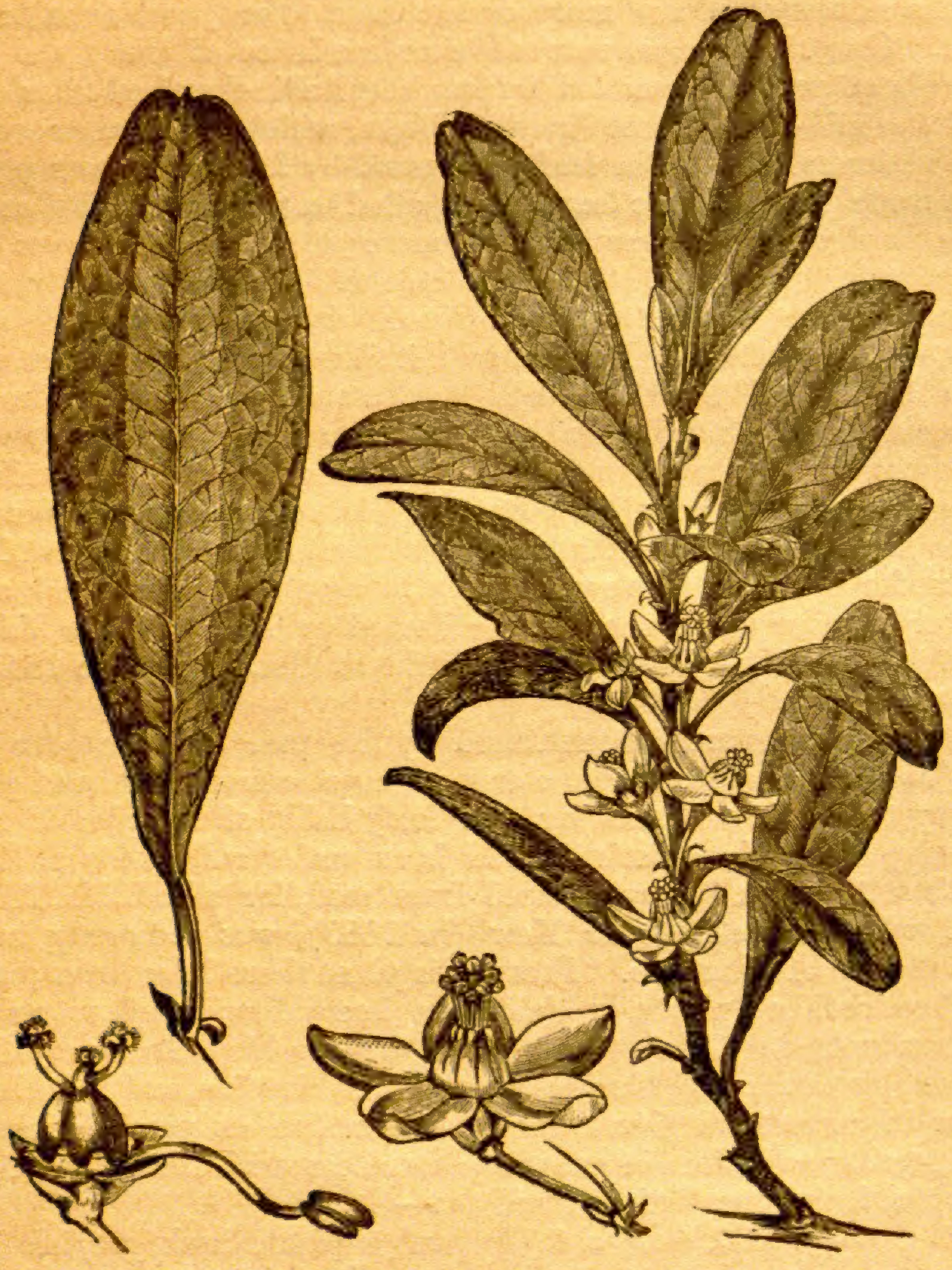

Fig. 2.
E. Coca, var. *novo-granatense.*

The Culture and Preparation of Coca Leaves.

In the Andes the Coca plant succeeds best in the mild but very moist climate of the lower mountains, on elevations between 2,000 and 5,000 feet above the level of the sea. The thermometer at this elevation does not often fall below 60° Fahr., and the climate is free from any great or sudden changes. It appears that Coca, like Coffee, succeeds best on mountain slopes, where the soil is rich in humus, with perfect drainage. Swampy land is very unsuitable, and so also, according to Poeppig, is land strongly impregnated with lime. From the experience gained in cultivating Coca in other parts of the world, it appears that the plant thrives in warmer localities than were at first supposed to be suitable for it. In many tropical countries it will grow at sea-level, provided there is sufficient moisture in the air and the rains are pretty equally distributed through the year. It will not thrive at the higher elevations at which Coffee is grown in either the East or West Indies

An elevation midway between those mentioned above will probably prove most suitable, regard being had to the fact that the lowest minimum temperature does not fall below 65° Fahr. Shade is said to be unfavourable to the development of alkaloids in the leaves. Dr. Rusby has made repeated analyses of shade-grown and sun-grown leaves, with the result that the latter were invariably found much richer in total alkaloids. Plants appear to be generally raised from seed, and when 8 or 10 inches high they are put out in their permanent places during the rainy season. The care and cultivation suitable to tea or coffee plants would appear to be also those necessary to the cultivation of the Coca plant. The crop is a leaf crop similar to tea, and there would appear to be nothing special in the requirements of the plant, which is found to be hardy and easily managed.

In Peru plants begin to yield the first crop of leaves in three years after planting, but in poor soils the plants are often left until the fifth year. The full-grown shrub yields a harvest every 13 or 14 months, but as the ripeness of the leaves, which is proved by their breaking when taken in the hand and bent, depends very much on the soil and situation and the age of the plants, in many large plantations the collecting goes on throughout the year. In some favourable localities two or three good crops are gathered in the year.

In tea the very young leaves only are gathered. In Coca, on the contrary, the largest and most matured leaves are sought, as these latter contain most of the alkaloids which render the Coca leaves a marketable product. After being gathered the leaves in South America are usually dried in the sun on platforms; they are then heaped up to undergo a slight amount of sweating, and are then ready for use. According to Poeppig, if under peculiarly favourable circumstances the process of drying is accomplished in one day the leaves are esteemed the best, and are largely sought for, and fetch a high price. In this state the leaf is of a beautiful bright green colour, and quite smooth. The brown and less quickly dried leaves are cheaper.

As the result of analyses of sun-dried and shade-dried leaves which will be discussed later, it would appear that drying the leaves fully exposed to the sun is not so favourable for the production of Cocaine as drying slowly in shade. If leaves are artificially dried, the temperature, according to Dr. Warden, should not be much higher than 150° Fahr.

Now that Coca is being cultivated experimentally in other countries than South America, it is important to bear in mind that the standard of best Coca leaves is likely to change. "To a manufacturing chemist "the best quality would mean simply the quality that would yield the "largest percentage of crystallisable Cocaine, obtainable in the easiest "manner, while the same Coca might be considered for domestic con-"sumption (amongst the natives of South America) one of the lower "grades. It is highly probable that the amount of Cocaine forms no "element in the Indian's estimate of the quality of Coca any more than "the percentage of nicotine establishes the quality of a particular grade "of tobacco. Coca leaves are classed by the Indians as *Najas dulces* "(sweet leaves) and *Najas amargas* (bitter leaves). The former are "made sweet by the abundance of alkaloids other than Cocaine, while "in the latter the bitter flavour of Cocaine is the predominant one."*

Good Coca leaves unbroken are of a fine green colour and possess a delicate, agreeable, somewhat aromatic odour, which is specially perceptible when they are bruised, and which has been compared to the combined odour of hay and chocolate. Specimens are often met with in which the green colour is replaced by brownish yellow or reddish brown, and the odour lost, or more or less disagreeable. Coca when fresh has a somewhat grassy, aromatic, and slightly bitter taste, and when carefully dried it has a similar flavour, but in other cases its aroma is lost, and it is simply bitter and disagreeable.*

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* Rusby in *Therapeutic Gazette*, vol. ii. pp. 15, 16.

CHEMICAL NOTES.

As the value of Coca leaves outside of South America depends almost entirely on the amount of Cocaine yielded by them it has been considered desirable to supplement these notes by such chemical information as bears directly upon the cultivation of the Coca plant in various parts of the Colonies and India. In the preparation of this information we are indebted to Mr. Alfred G. Howard, F.C.S., F.L.S., grandson of the late Mr. John Eliot Howard, F.R.S., the well-known authority on Cinchona. By the aid of correspondents in the West Indies, Ceylon, India, and Java, numerous samples of Coca leaves grown in those countries were obtained with full particulars as regards the circumstances under which the plants were cultivated and the methods adopted in drying the leaves. These leaves were carefully analysed by Mr. Howard, and the results are of a very interesting character. They point out not only the best kinds of plants to grow, but also the circumstances best suited to produce a high per-centage of alkaloids, and the best methods for gathering and curing the leaves.

It is important to point out that the per-centages of alkaloids often quoted in regard to Coca leaves cannot be compared with one another, owing to different methods pursued in dealing with them. Mr. Howard states that the alkaloid determined in all his analyses "is simply " Cocaine in a pure state which is split up into crystallisable and " uncrystallisable Cocaine as nearly as could be done when working " with such small quantities."

The following analyses of Coca leaves, for convenience of reference, have been divided into four series :—

ANALYSES of LEAVES of COCA.

Localities.	Per cent. Crystallisable.	Per cent. Uncrystallisable.	Total Cocaine.	Elevation.	Remarks.
				Feet.	
A.—Ceylon - -	0·60	0·00	0·60	2,300	Dried in the sun.
„ - -	0·60	0·00	0·60	1,500	Dried in the shade } Grown at Botanic Gardens, Peradeniya.
„ - -	0·47	0·00	0·47	1,500	Dried in the sun -
British Guiana	0·22	0·33	0·55	Sea-level	Dried in the shade.
B.—Java - -	0·30	0·09	0·39	820	Grown at Buitenzorg.
„ - -	0·34	0·09	0·43	3,000	„ „ Sockaboemi.
„ - -	0·24	0·08	0·32	5,000	Dried in the sun.
C.—Jamaica -	0·33	0·43	0·76	100	Dried in the shade { Plants 6 months old ; grown at Spring Gardens Estate.
„ -	0·24	0·16	0·40	100	„ „ sun -
„ -	0·25	0·33	0·58	600	Dried in the sun { Plants 5–6 years old; grown at Castleton Gardens.
„ -	0·20	0·45	0·65	600	„ „ „
St. Lucia -	0·22	0·33	0·55	Sea-level	Dried in shade.
D.—India - -	0·45	0·35	0·80	900	Darjeeling.
„ - -	0·27	0·23	0·50	—	Bogracote.
„ - -	0·23	0·20	0·43	—	Alipore; dried in shade 10 days.
„ - -	0·30	0·23	0·53	2,200	Ranchi, Chota, Nagpore.
„ - -	0·41	0·17	0·58	2,200	„ „ „ dried in shade, then rolled and fermented like tea.

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* Bent. and Trim. Med. Plants, vol. i. t. 40.

In the Annual Report of the Botanic Gardens, Ceylon, for the year 1887, Dr. Trimen, F.R.S., states that the Coca plants at Peradeniya and possibly all the plants now in the Colony have been derived from a Kew plant received in 1870. As there has been only one Coca at Kew such plants would necessarily belong to the variety *novo-granatense* (Fig. 2) already described. The specimens of leaves received from Dr. Trimen for analysis with his letter of the 27th February 1888 appear, however, to belong to the typical Peru plant (Fig. 1). They are in some cases 3½ inches long and 1½ inch wide; they are oval-pointed, dark green, and correspond very nearly with specimens collected in Peru by Mr. Pearce. The analyses of the Ceylon leaves show exceptional richness in crystallisable Cocaine; they have no uncrystallisable Cocaine and the total yield is the highest, with two exceptions, of any received. Of the two specimens grown at the Botanic Gardens, Peradeniya, it will be noticed that the leaves dried in the shade yield ·60 per cent. of Cocaine while the same leaves dried in the sun yield only ·47 per cent. Leaves grown in Ceylon at 1,500 feet, and 3,000 feet respectively show the same results. The difference of elevation has apparently not produced any effects on the yield in Cocaine.

The leaves received from British Guiana are not distinguishable in general characters from the Ceylon leaves. They are perhaps less coriaceous, but have the same dark green colour on the upper surface and are quite as large. The yield of Cocaine is somewhat less, but while in the Ceylon leaves there is no uncrystallisable Cocaine, in the British Guiana leaves the amount is ·33 per cent. If it should be proved that this is a highland plant it would not be likely to be so productive in alkaloids at sea-level in the tropics.

The Java leaves represent Coca grown at 800 feet, 3,000 feet, and 5,000 feet respectively. They belong to the intermediate forms provisionally classed as Bolivian with narrowly oblong leaves, pointed, dark green above and glaucous beneath. They contain chiefly crystallisable Cocaine, the results of the most favourable sample yielding ·34 per cent. crystallisable Cocaine and ·09 per cent. uncrystallisable Cocaine. The leaves grown at an elevation of 5,000 feet show a less favourable result than those grown at either 800 feet or 3,000 feet. This may be owing in part at least to the fact that they were dried in the sun. Mr. Howard states that the Bolivian leaves which usually reach this country from South America contain ·40 per cent. of crystallisable Cocaine and ·05 of uncrystallisable.

The plants grown at Jamaica and St. Lucia are characteristic of the variety *novo-granatense*. They are all apparently derived from the Kew plant. The leaves are obovate, blunt, or emarginate, and membranous, and of a light grassy green colour when dry. In one instance the total yield in Cocaine is exceptionally high. This occurs in leaves forwarded by the Hon. W. B. Espeut grown at Spring Garden Estate. The larger proportion of the Cocaine is, however, uncrystallisable. These leaves were from plants only six months old grown at nearly sea-level and dried in the shade. The same leaves dried in the sun appear to have lost ·36 per cent. of Cocaine. Leaves grown at the Castleton Gardens at an elevation of 600 feet, in perhaps less rich soil, yield ·65 per cent. of Cocaine, of which ·45 per cent. is uncrystallisable. A good series of such leaves were obtained from Mr. W. Fawcett, F.L.S. There is apparently a considerable difference in the yield of Cocaine in leaves gathered at different seasons in the year. This may account for the different yield of plants grown at sea-level in Jamaica and exactly similar plants grown at sea-level at St. Lucia. In the one case the yield is ·76 per cent. of Cocaine, in the other it is only ·55 per cent. The general conclusion would point to the variety *novo-granatense* as being a lowland plant capable of growing in hotter conditions than those suitable to the type. Leaves taken from plants grown at Kew yielded ·44 per cent. of Cocaine, of which ·10 per cent. was crystallisable. Of leaves grown in India one sample forwarded to Kew by Mr. Sackville Cresswell, grown at Darjeeling at an elevation of 900 feet, gave the highest per-centage of total Cocaine, but a large proportion was uncrystallisable. The other leaves forwarded by the Secretary of the Agricultural and Horticultural Society of India have been already very fully discussed by Dr. Warden, M.D., F.R.C.S., in a *Note on Erythroxylon Coca grown in India*, published in Vol. viii., part iii., new series of the *Journal* of the above Society.

An interesting point connected with these leaves is brought out by Mr. G. Peppe, of Ranchi, Bengal. One set of leaves, dried in the sun, yielded ·53 per cent. of Cocaine, of which ·23 per cent. was uncrystallisable. The same leaves "dried in the shade on cloth for 20 hours, " then rolled by hand like tea, then fermented 2½ hours, dried over a " charcoal fire and put up in a closed tin box," yielded ·58 per cent. of Cocaine, of which only ·17 per cent. was uncrystallisable. These latter leaves were obtained from plants imported from Paris; the other Indian leaves were from plants introduced by the Agricultural and Horticultural Society of India. In general character they are all very much alike, approaching the Bolivian form perhaps in shape and colour, but evidently possessing the characteristics of Truxillo Coca in the high per-centage of uncrystallisable Cocaine contained in them.

The above results confirm the opinion already formed that there are several varieties of *Erythroxylon Coca* existing in South America, some of which have been now introduced into the Old World. These varieties have no doubt their own range of elevation at which they may be successfully cultivated, as well as characteristics more or less marked in the yield of crystallisable Cocaine.

The typical plant, Fig. 1, appears to be the best plant to cultivate at higher elevations, and if the object is to obtain a large yield of crystallisable Cocaine. The variety *novo-granatense* thrives at sea level in the tropics, and yields nearly, if not quite, as high a per-centage total Cocaine, but a large proportion of it under present chemical methods is uncrystallisable. The latter plant, judging from cultivated specimens in this country, appears to yield a larger crop of leaves than the type, but fruits somewhat sparingly.

As regards yield of crystallisable Cocaine we have apparently amongst Coca plants very much similar conditions as amongst Cinchona plants. In the latter, *Cinchona succirubra* yields a large proportion of total alkaloids like the variety *novo-granatense*, but only a small amount of crystallisable quinine. On the other hand, *Cinchona calisaya* (like the typical Coca plant) yields a smaller total of mixed alkaloids but a larger yield of crystallisable quinine.

OTHER SPECIES OF ERYTHROXYLON.

There are numerous other species of Erythroxylon distributed throughout the inter-tropical regions of both hemispheres. The head-quarters of the genus is in tropical America, whence more than one hundred species have been already described.

The important properties which exist in the leaves of *Erythroxylon Coca* have naturally drawn attention to other species, in the hope that their leaves might contain the same or similar principles. It is well known that the wood of numerous species is hard and yields a red dye. The young shoots of *Erythroxylon areolatum*, a native of Jamaica and of the northern parts of South America, are said to be a mild stimulant; the bark is a tonic, and the juice of the leaves is used externally against herpetic affections.

Erythroxylon monogynum (Sethia indica), a native of the East Indies, known under the Madras native name of *Gadara*, possesses a timber that is slightly fragrant, and Ondaatje records that a creasotic oil has been prepared from it. The leaves of this plant were used by the natives of India to mix with their food during the last famine.*

During the course of the present inquiry an effort has been made to procure as many samples as possible of leaves of various species of Erythroxylon in order that they may be analysed by the same method as that adopted for the Coca leaves. It might be naturally supposed that the two species already mentioned (*E. areolatum* and *E. monogynum*) which have gained a local reputation for medicinal properties would contain the larger amount of the characteristic Coca alkaloids. The leaves of *Erythroxylon areolatum*, grown at Jamaica, received from Mr. Fawcett, and dried in the shade contained ·035 per cent. of Cocaine, while similar leaves dried in the sun yielded ·023 per cent. of Cocaine. Leaves of *Erythroxylon Coca* from the same island have already been shown to contain ·76 per cent. of Cocaine,—so the quantity yielded by the indigenous plant is therefore only about one twenty-fourth part of that yielded by *E. Coca.*

No leaves of *E. monogynum* were obtainable for Mr. Howard, but reference may be made to an analysis undertaken by Dr. Warden of leaves obtained in Calcutta which "yielded ·04 per cent. of a principle "which, however, did not possess the physiological properties of "Cocaine."†

At the Botanical Gardens at Java Mr. Eykman, formerly Professor of Chemistry and Pharmacology at the University of Tokio, carried on researches into the properties of local species of Erythroxylon, which are fully borne out by the analyses of Mr. Howard with similar leaves sent to Kew by Dr. Treub. Mr. Eykman analysed the leaves of *Erythroxylon montanum, E. laurifolium,* and *E. retusum.* The amount of alkaloids found in them was in no case higher than one-tenth of that contained in the leaves of *E. Coca.* The bark of *E. montanum* and *E. retusum* contained an inappreciable amount of alkaloids, while the fruit contained only a trace.‡ The Java leaves analysed by Mr. Howard contained the following per-centages of alkaloids, *E. montanum* ·03 per cent., *E. laurifolium*, ·05 per cent., and *E retusum*, ·03 per cent.§ The highest per-centage reached by leaves of *E. Coca* received from Java (already noted) was ·43 per cent. Hence, according to these figures, the indigenous species yielded only one-ninth to one-fourteenth of the alkaloids yielded by *E. Coca.* Leaves of *E. macrophyllum* received from Mr. Jenman, Botanic Gardens, British Guiana, contained not a trace of alkaloids, while the leaves of *E. ovatum* yielded

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[*] Official Papers of the Government of Madras, Rev. Depart., 29th Sept. 1835, No. 1105.

[†] Note on *Erythroxylon Coca* grown in India by C. J. H. Warden, M.D., F.R.C.S., reprinted from Journal Agri.-Hort. Soc. India. Vol. VIII., Part ii.

[‡] Annales du Jardin Botanique de Buitenzorg, Dr. M. Treub, Directeur. Vol. vii., Part 2, pp. 224-229. Leide, E. J. Brill. 1888.

[§] Mr. Howard states that these results are not quite free from doubt. They are, however, very near those obtained by Mr. Eykman, and give almost identical proportions as compared with *E. Coca.*

·02 per cent. of alkaloids. This latter species is found in many of the West India Islands as well as in South America. It is known at Dominica as *Bois vinette.* A specimen in the Kew Herbarium, collected by Lechler in Peru in 1854, and named by Griseback *E. ovatum*, was marked "culta sub-nomine Coca, San Govan." From the character of this specimen there could be little doubt that it was only a form of *E. Coca*, and the amount of alkaloids contained in the leaves would have fully justified its being accepted as the true thing.

To summarise the results obtained from an examination of the leaves of local species of *Erythroxylon*, it is pretty clear that no species yet examined yields alkaloids at all comparable in quantity to those found in *E. Coca*. The bark of these species appears to contain even less than the leaves, while the fruit and seed contain only a trace of alkaloids. The following table will show the results as far as they are now obtainable. The yield of *E. Coca* is placed at the head of the list for comparison :—

Species.		Per-centage of Alkaloids.	Habitat.
Erythroxylon	Coca - -	0·760	Grown at Jamaica.
”	areolatum - -	0·033	Jamaica ; dried in shade.
”	” - -	0·023	” ” ” sun.
”	macrophyllum -	0·060	British Guiana.
”	ovatum - -	0·020	” ”
”	montanum - -	0·030 ?	Java.
”	laurifolium - -	0·050 ?	”
”	retusum - -	0·030 ?	”
”	monogynum - -	0·040	India.*

* Analysis of Dr. Warden.

PRESENT VALUE OF COCA LEAVES.

Since the discovery of the anæsthetic properties of Cocaine the demand for Coca leaves in South America has considerably increased for export purposes. A distinct loss in the alkaloids generally, as well as in Cocaine, has been noticed during the transit of leaves to this country, and latterly, in consequence, it has become the practice to extract the alkaloids from the leaves in South America and export to the United States and Europe a crude preparation which is largely taken up by manufacturers of Cocaine.* The demand for Coca leaves has therefore fallen off, and it is probable that the cultivation of the Coca plant in our tropical Colonies may never assume large proportions. Small and exceptionally fine samples of Coca leaves may find a limited market in this country or on the Continent; and possibly in India and Eastern countries it may be worth while to grow sufficient leaves to meet the local demand for Cocaine. Beyond this it is scarcely possible to go, if it is borne in mind that South America is able without further extension of cultivation to produce such enormous quantities of Coca leaves, that the one-eightieth part would be sufficient to swamp the Cocaine markets of the whole world. In a letter dated January 25th, 1888, Messrs. Burgoyne, Burbidge, Cyrian, and Farries reported that the commercial value of "Coca leaves yielding total alkaloids of ·80 per cent. would "be about 6*d.* to 8*d.* per pound. At present it is difficult," they say "to get a true valuation on account of absence of demand . . . . . "The average price last year (1887) was about 8*d.* per pound, taken "all round." In a letter dated the 9th November 1888 Messrs. Burgoyne state "very few parcels of Coca leaves now come before us on "the market as the manufacturers of Cocaine either deal directly with "the shippers of the leaves or possibly buy the crude extract for manufacturing purposes. The demand for the alkaloid increases, and the "price of the leaves varies from 10*d.* to 1*s.* 6*d.* per pound. In the "absence of statistics of stock here we cannot say what the probable "future of the article is with regard to price." In a further letter dated the 5th December 1888 Messrs. Burgoyne kindly forwarded the following interesting information respecting Coca leaves in the United States: "We have just heard from New York that the stock of Coca "leaves in that city consists of 10,000 pounds of Huanuco leaves, and "40,000 pounds of Truxillo leaves. These were all imported this year, "and are good green leaves. The Huanuco leaves are the kind used for "making Cocaine, but since the large quantities of crude Cocaine "arrived from Lima on the European markets there has not been such "an active inquiry, and the price has declined to 22 cents (elevenpence) per pound. It is a well-known fact that they cannot be "imported under 26 cents (thirteenpence) per pound, and when the "small stock of 10,000 pounds is gone, higher rates will no doubt be "obtained for Huanuco leaves. The Truxillo leaves, on the other "hand, are only used in pharmacy and for Coca wine. They are as "strong as the other kind in alkaloid, but the product will not crystallise. The stock in hand, viz., 40,000 pounds, is a large one, and "the price may probably go down to 15 cents [sevenpence halfpenny]."

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* This crude alkaloid contains about 70 per cent. of pure crystallisable Cocaine, and is selling for about 15*s*. per ounce.

LXXVII.—BEETLES DESTRUCTIVE TO RICE-CROPS IN BURMA.

Mr. Arthur E. Shipley, F.L.S., Fellow of Christ College, Cambridge, and Lecturer on Entomology at the Indian Civil Engineering College, Cooper's Hill, communicates the following report for publication in the *Bulletin* :—

On November 24th I received a collection of beetles from Burma preserved in spirit. The beetles were all of one species, and in an excellent state of preservation. As I was unable to be in London, I am indebted to my friend, Mr. W. F. H. Blandford, for a careful comparison of some of the beetles with the single specimen of the same species in the British Museum, and for some observations on the character of the species.

The name of the beetle is *Chætocnema basalis* (Stephens), and a description of it is given by Mr. J. S. Baly in the "Transactions of the Entomological Society of London" for 1877, p. 310. The beetle is there described as occurring in India.

The genus *Chætocnema* was established by Stephens, and covers almost the same ground as the genus *Plectrocelis* of Chevrolat.

In a letter accompanying the beetles, it is stated that they do much damage to the young paddy in the rice-fields of the Taungyas in the northern part of the division of Tharrawaddy. The beetles appear in June when the paddy is about 6 inches high, and first attack the leaves, and then pass on to the stem and roots. The hill tribes or Karens in this district state the beetle has appeared before; but the Burmans are doubtful if this is the case. The natives call the insect *Wetpo.*

I am unacquainted with the methods of the cultivation of rice in Burma, and the life history of *Chætocnema bacalis* has still to be worked out, so that it is difficult to suggest any means of combating the pest. However, I have added a few remarks on the habits of the family *Halticidæ,* and of the means used in various parts of the world in dealing with insect pests of this family. I do not imagine that the latter will be of direct use in Burma, but they may possibly suggest some practical methods to anyone acquainted with the local features of the pest.

I understand that the rice in the Taungyas is grown by a dry method of cultivation; this would agree with the habits of the *Halticidæ,* which as a rule avoid damp or swampy places.

The fact that the beetle is well known to the Karens, and not so well known to the Burmans, is possibly owing to the beetle living in the hills and not descending to the plains.

The family *Halticidæ* contains a great number of species of minute beetles. The family is a very homogenous one, the difference between the various species being very slight. A common feature of the group is the adaptation of the posterior legs for springing, a feature which in conjunction with their minute size, has given rise to the popular name of *flea-beetle.*

As a rule the beetle passes the winter in the imago condition, and during the following spring the eggs are deposited in the under surface of the leaves of the plant infested by the beetles. The eggs take in temperate climates from 7 to 14 days to hatch, and the larvæ which then emerge are minute, linear, whitish grubs, with a black or yellowish-brown head. They are provided with six pairs of legs. The larvæ after existing for a longer or shorter period become pupæ.

The pupæ are white, and often enclosed in an earthen cocoon in the ground.

Many species have two broods in the year. The larval stage of the cycle of development is the one during which most damage is effected. The minute white grubs bore through the tissues of the infested plant, keeping between the upper and under epidermis of the leaves and devouring the soft mesophyllor intermediate layer. Sometimes, however, they devour all the tissue between the veins of the leaves, thus reducing it to a skeleton. The beetles also eat the leaves.

The following are some of the methods which have been successfully used in dealing with the injurious members of *Halticidæ.*

These beetles seem to have a great objection to dust which possibly gets between their legs and impedes their movement. Hence plants which suffer from the attacks of the *Halticidæ* are often protected by being sprinkled with any kind of finely divided matter which is itself innoxious to the plant. Amongst these substances powdered lime, soot, road-dust, ashes, and sulphur have been used with success. Sulphur may be applied dry or suspended in water.

Of liquid applications the following have proved effective: (i.) A solution of whale-oil soap in the proportion of 2 lbs. of soap to 16 gallons of water.

(ii.) An extract of wormwood, made by pouring a pailful of boiling water over a handful of wormwood and letting it stand for 12 hours.

This bitter extract renders the plants treated with it very distasteful to the beetles.

The liquid applications should be applied with a syringe, which produces a fine spray. Both liquid and dry substances should be distributed early in the morning whilst the dew is on the plants and the beetles torpid and inactive.*

The land should be kept as clean as possible, all rubbish, broken wood, &c. should be cleared away. It is possible that the beetles pass the winter in such rubbish, which should therefore be burnt or otherwise destroyed. All weeds should be removed, and it should be noted whether the beetles attack any common weed, as the Turnip flea does the Charlock, in which case special precautions should be taken for the destruction of the weed.

The roots and stems of the Rice must never be left about, as very probably the beetle passes the period which elapses between the reaping of the crop and the sowing of the succeeding one concealed in some refuse of the first crop. All such refuse should be collected and burnt.

A deep mode of cultivation is often useful, as it serves to bury the beetles and the pupæ at a depth from which they cannot escape to the surface again.

In temperate climates the *Halticidæ* can be kept away from a crop by the presence of moisture and shade, they flourish only in sunny places.

A method which has been much used in the United States, in fighting with the Grape-vine Flea beetle *Graptodera* (Haltica) *chalybea*, is to shake the beetle off the vine into pans containing kerosene or some such oil. Another method is to shake them into a piece of canvas, kept open by two sticks, one at each end, the canvas having been previously soaked in kerosene.

The kerosene kills the beetles almost at once. Smearing the pans or canvas with tar, kept moist by admixture with oil or grease, would probably serve the same purpose.

Christ's College, Cambridge,
December 15, 1888.

LXXVIII.—FIBRE FROM LAGOS.

(*Honckenya ficifolia*, Willd.)

Botanical specimens as well as a specimen of fibre were recently received at Kew through the Colonial Office from the Governor of Lagos. These specimens have proved interesting as bringing under notice, apparently for the first time, a valuable fibre-plant on the West Coast of Africa. The plant has been determined as *Honckenya ficifolia*, Willd. (Clappertonia ficifolia, *Decaisne*), a member of the natural order *Tiliaceæ*. It is fully described in Oliver, *Flora, Tropical Africa*, Vol. i. p. 260. Below will be found the official correspondence bearing on the subject, including a report of Messrs. Ide and Christie on the commercial value of the fibre:—

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* For further details of Insecticides, c.f. "Notes on Economic Entomology," No. 2, by E. C. Cotes, Calcutta, 1888.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 12th December 1888.

I AM directed by the Secretary of State for the Colonies to transmit to you, for your observations, a despatch from the Governor of Lagos, enclosing a correspondence with Mr. Alvan Millson respecting a local fibre-yielding plant known as "Bolobolo" or "Agbonrin Ilassa."

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director,
Royal Gardens, Kew.

[Enclosure.]

MY LORD, Government House, Lagos, 1st November 1888.

I BEG to trouble your Lordship with a copy of the correspondence with reference to a local fibre-yielding plant known in the Popo vernacular as "bolobolo" and in Yoruba as "Agbonrin Ilassa," which has been supplied by Mr. Millson, the Commissioner of the Western District.

The correspondence covers herbarium specimens and a sample of the fibre on which this Government would be obliged to be favoured with an expression of opinion by the Director of the Royal Gardens, Kew.

I have, &c.
(Signed) C. A. MOLONEY,
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

DEAR SIR, 72, Mark Lane, London, E.C., 17th December 1888.

WE have your favour of the 15th instant, with specimen of "Bolobolo" fibre from Lagos. We consider this a very valuable fibre of the jute class, but distinctly superior to the latter in many respects, and more particularly in strength. It is of good length and well cleaned. If this fibre is capable of being produced in large quantities there is a very wide field open to it commercially. Its market value would be regulated by that of jute, but in our opinion it would always command a higher price. At to-day's currencies it would sell at 16*l*. per ton in London. We do not think the minimum price would ever fall below 12*l*., and if the jute market made a further advance, this "Bolobolo" fibre might realize 20*l*. If this fibre could be prepared of a whiter colour it would prove still more acceptable; but even as it is, we should be very glad to see large quantities placed on this market, where they would sell readily.

We are, &c.
(Signed) IDE AND CHRISTIE.

D. Morris, Esq., M.A., F.L.S.,
Royal Gardens, Kew.

LXXIX.—YAM BEAN.

(*Pachyrhizus tuberosus*, Sprengel.)

In the *Kew Bulletin* for August 1887 information was given respecting the introduction of certain West Indian food-plants to the East Indies. The subjects then treated were the Tree-tomato (*Cyphomandra betacea*); the Chocho (*Sechuim edule*); the Arracacha (*Arracacia esculenta*), and the Cherimoyer (*Anona Cherimolia*).

Although not indigenous to the West Indies, the subject of the present notice has been for a long period cultivated there. Its earliest modern systematic name is *Dolichos tuberosus* (Lamarck, Dict. II. p. 296). It is figured by Plumier, *Plant. Amer.*, pl. 220; and also by Descourtilz, *Flore des Antilles* (1829), viii. p. 127, pl. 554, who states that it was grown in Martinique, and believed to have been brought from the Spanish Main by the Caribs. It was transferred from the genus *Dolichos* to *Pachyrhizus* by Sprengel (*Systema Vegetabilium*, Vol. iv., part i., p. 281). By modern writers it appears to have been included under *Pachyrhizus angulatus* D.C. (Dolichos bulbosus, *Lamarck*), from which, however, it differs by the leaves being rounded not dentate; by the white, not violet flowers; by the much larger pods; and possibly also by the seeds, which are kidney-shaped, white, black, or mottled.

A good figure of *Pachyrhizus angulatus*, to which reference may be made for purposes of comparison, appears in the *Flora Brasiliensis*, Vol. XV., pt. i., pl. 53; there is also a figure in Plumier's *Plant. Amer.*, pl. 222.

In February 1886, Dr. Ernst, of Caracas, wrote respecting some specimens he was sending to Kew, as follows:—"Is there really a "*Dolichos tuberosus* cultivated or wild in the Antilles? I have a "plant from Merida, which agrees well with Plumier's, plate 220, but "it is a *Pachyrhizus*. I see Sprengel has already reduced *D. tuberosus* to *Pachyrhizus*; but it appears that it is not generally admitted. "Grisebach speaks of *Dolichos tuberosus*, and Bentham and Hooker "(in the *Genera Plantarum*) say there are but two species of *Pachyrhizus* (*angulatus* and *palmatilobus*). Is it perhaps their opinion that "*D. tuberosus* is only a variety of *Pachyrhizus angulatus?* I send "to-day leaves, fruit, and seeds of my Merida plant. The root is "edible; it is certainly what Weddell (*Ann. Sci. Nat.*, 4, Vol. vii.) "describes under the native name of *Ahipa;* the young roots are just "as he says; when older they get much larger and lose their fusiform "ends. I should like to see the text of a good description of "*D. tuberosus*. I have only that of Lamarck."

In April 1887 seeds, under the name of *Dolichos tuberosus*, were received from Mr. J. H. Hart, F.L.S., Superintendent of the Botanical Gardens at Trinidad. These were distributed to the Botanic Gardens of Calcutta, Ceylon, Brisbane, Melbourne, Sydney, and Adelaide. The seeds sent to Ceylon were grown by Dr. Trimen, and he discovered that not only were the tuberous-like roots edible, but that the pods were a very useful vegetable. He wrote: "January 30, 1888:—Last year "you sent me some seeds of a tuberous vegetable labelled *Dolichos* "*tuberosus*. These grew well . . . . . They are quite new to "Ceylon, the vegetable being quite unknown here, and I fancy little "grown in India. The young pods, served like French beans, are an "admirable vegetable, tender and sweet; and the elongated arrowroot-"like tubercles on the roots are also good when cooked. Altogether

" the plant is a decided acquisition to the vegetable garden. The " flowers are pure white here."

Specimens of leaves, flowers and fruit were recently received from Dr. Trimen, and these, together with the specimens already received from Dr. Ernst, were sufficient to establish the fact that *Dolichos tuberosus* of Lamarck, a native of tropical South America, although hitherto included under *Pachyrhizus angulatus*, D.C., was a good species. It was decided to keep it apart under the name of *Pachyrhizus tuberosus*, Sprengel. A figure and description will shortly appear in the *Icones Plantaram*, and in the meantime it is desirable to place on record what is known of it as an economic plant.

In Jamaica it is cultivated under name of the Yam bean. The following account is given of it and its uses by Macfadyen in the *Flora of Jamaica*, p. 285:—" Flowers white. Seeds red. The root is formed " of a number of simple cord-like fibres, several feet in length, stretching " under the surface of the ground, bearing in their course a succession " of tubers. The beans are poisonous, but the root affords a very " plentiful supply of very wholesome food. The produce of three " plants is usually sufficient to fill a bushel basket. The tubers may " either be boiled plain, in which state they are a very good substitute " for yams and other roots in common use ; or they may be submitted " to a process similar to arrowroot, and a starch obtained. This starch " is of a pure white, and is equal in every respect to arrowroot.

"To the taste it is very palatable, is easily digested, and is employed " for custards and puddings. Even the trash left after obtaining the " starch, and which in the preparation of arrowroot is lost, may, when " thoroughly dried, be formed into a palatable and wholesome flour. A " very excellent flour may also be obtained by slicing the tubers, drying " them in the sun, and then reducing to a powder. This plant is deserving " of being more generally cultivated than it has hitherto been. It ought " in a great measure to supersede the arrowroot in cultivation. It can be " planted at any season of the year, and the roots are fit for digging in the " course of four or five months ; the return is infinitely greater than that " from arrowroot, and the proportion of starch also is more abundant, " so that it can be brought to market at so cheap a rate as to admit of " being employed by the calico printers in place of potato-starch. The " Yam bean has of late years been partially cultivated in this island. It " is said to have been introduced from Martinique."

Macfadyen, it is noticed, speaks of the seeds as being poisonous. Spruce, who collected what appears to be the same plant at Tarapota in South America, in 1857, describes it as "herba volubilis 10–20 pedalis, pro- " tuberis maximis, edulis culta." The Peruvian name is stated to be *Ashipa*, and he adds " the seeds are poisonous." It is well known that in the uncooked state the seeds of the ordinary kidney bean are said to be also poisonous. There can be no doubt whatever the Yam bean is perfectly wholesome when cooked, both as regards the pods and the root tubers. It is also perennial and altogether constitutes one of the most valuable food plants for tropical countries. In a recent letter Dr. Trimen states, " I have been having large crops of beans lately ; the stems sent " up from the yams of last year bearing freely. What constitutes their " superiority over the ordinary French beans is the absence of any " fibrous string along the sutures of the pod. The large size is also " an advantage ; they are often 10 or 12 inches long."

In the Museums of Economic Botany at Kew there are pods of this species from Jamaica, contributed by Mr. March, and also (with mottled seeds) from Mr. Spruce from Tarapota, Peru. There are seeds (red); specimens of dried tubers ; and a specimen of starch prepared from the tubers from Jamaica presented by Mr. D. Morris in 1883. Good specimen pods of *Pachyrhizus angulatus* are now desired in order to make he collection complete.

LXXX.—SCHWEINFURTH'S METHOD FOR PRESERVING PLANTS.

A useful method for preserving plants, especially those collected during the wet season in damp tropical forests where there are no facilities for drying paper, has been recommended by Dr. Schweinfurth, the well-known African traveller and botanist. Dr. Schweinfurth's first publication on collecting and preparing flowering plants and ferns for the herbarium appeared about 14 years ago in a book of instructions to scientific travellers (*Anleitung zu wissenschaftl. Beobachtungen auf Reisen.*) The following summary is taken from the *Bulletin of the Torrey Botanical Club* for November 1888, pp. 292–3 :—

" H. Schenck * calls the attention of collectors, especially those travelling in the tropics, to a method of preserving plants for the herbarium recommended by Schweinfurth, which he found exceedingly convenient and efficient during his travels in Brazil.

" The plants when collected are at once put between the sheets of a leather portfolio. On his return from the excursion the collector places the specimens between single sheets of common grey, unsized paper (to be had in every 'venda' in Brazil), which are firmly held together between two pieces of stout pasteboard by means of a strap. There the bundle is set upright in a tin box, and strong sugar-cane brandy or common alcohol is poured on the sheets from above, until the paper and the plants are thoroughly moistened and the liquid begins to run off below. The bundle or bundles are kept in the tightly-covered tin box until a quantity of them has accumulated. Then the straps and boards are removed, the single packages are wrapped up in paper and packed as closely and firmly as possible in a tin box about 2 feet high, which, finally, is tightly closed by soldering a flat cover to it. Several such boxes are packed in a wooden case for shipping. Some small tin boxes ought to be taken on more extended excursions.

" The preservation of plants after this method requires very little time (an advantage of the utmost importance for a traveller), for it is not necessary to arrange the specimens carefully between the sheets. The plants remain in good order, soft, pliable and moist, for years. and may be dried for the herbarium at the collector's convenience, after his return from his travels. They also remain in good condition for anatomical examination, and all kinds of flowers, as well as thick-leaved plants—such as many species of orchids, cactaceæ, &c.—will arrive at home in excellent order. Besides, plants may be collected and placed between the sheets in rainy weather."

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* In *Bot. Centralbl.*, vol. xxvv. p. 175.

LXXXI.—A STARCH-YIELDING BROMELIAD.

(*Puya edulis*, Morren.)

In arranging the drawings of *Bromeliaceæ*, and the manuscript notes relating to these plants, by the late Professor Morren, of Liege, lately acquired by the Bentham trustees, and presented by them to this establishment, a letter was found written by M. Lietze, of Rio Janeiro, in the year 1878, respecting a Bromeliad with esculent leaves. The plant to which reference is made is in cultivation in Europe, but it has not been seen by Mr. Baker, who is now engaged in monographing the family, except in a very young condition without flowers. It was published by Morren as a species of the genus *Puya*, but there can be little doubt that it is really a *Dyckia* of the species of which Central and Southern Brazil, and Uruguay are the head-quarters. Mr. Baker is of opinion that *Puya edulis*, Morren, is nearly allied to *Dyckia frigida*, Hk. f. (*Botanical Magazine*, t. 6291), of which *D. regalis*, and *Pourretia frigida* are garden names. So far as at present known, the genus *Puya* is confined to the Andine region. The following is an extract from the letter of M. Lietze :—

"Rio Janeiro, 23rd September 1878.

"I beg to tender you my warmest thanks, and I am rejoiced to be able to send you by post two packets, containing (1) a young plant of a Bromeliad from the basin of the Rio Doce; (2) seeds of the same; (3) portions of dry leaves, ready to be crushed for the extraction of the starch; (4) the same starch ready for consumption. This vegetable has saved many people, especially Indians, from dying of hunger. The specimens have travelled nearly three months, and all may be altered by the moisture.

"The species has a strong habit, as the portions of the leaves, and also an old trunk, which reached me in a rotten condition, show.

"The case presents novelty enough to me. The extraction of starch from the leafy parenchyma was strange to me, but could not be doubted. When I visited Rio Doce, the people often spoke to me of this vegetable, assuring me that the product was eagerly sought after as an article of food.

. . . . "A. LIETZE."

The first description of the plant from the pen of Professor Morren appeared in *La Belgique Horticole*, 1878, p. 354 :—

"*Puya edulis* (sp. nov.). There grows in Brazil, in the province of Rio Doce, a Bromeliad which furnishes in abundance an excellent fecula. This alimentary substance accumulates in the leaves, which it is necessary to crush in order to obtain it in abundance. The plant, which has a stem, attains large dimensions. The base of the leaves, which are very spiny, measures as much as 2½ inches across. This plant has saved the lives of thousands of Indians during the famine, which has recently desolated certain provinces in Brazil. We have not seen the flowers, but to judge from the habit, and especially from the seeds, it ought to belong to the genus *Puya*."

LXXXII.—THE FRUITS OF MYSORE.

Mysore is a native state in Southern India, with Bangalore as the head-quarters of the Government. It has an estimated area of 24,723 square miles, and consists of an undulating table-land, much broken by ranges of rocky hills, and scored by deep ravines. These latter characteristics are due to the fact that it is situated in the angle where the eastern and western Gháts converge with the group of the Nílgiri Hills. The general elevation of the country increases from about 2,000 feet above the level of the sea, along the northern and southern frontiers, to about 3,000 feet at the central water-parting which separates the basin of the Kistna from that of the Káveri.

The city of Bangalore stands in the centre of the Mysore table-land at an elevation of 3,113 feet above the level of the sea. At this elevation the climate differs very materially from that usually associated with Southern India. The mean annual temperature is 76·2 F., and the annual rainfall is 36 inches. A picturesque garden known as the Lal Bagh, or red garden, under the charge of Mr. J. Cameron, F.L.S., formerly of Kew, is one of the most attractive features of Bangalore.

Owing to the advantages of site and climate the Lal Bagh is capable of producing the vegetable products of sub-tropical countries as well as those indigenous to India. In this respect it occupies an intermediate position between the temperate and torrid zones. The climate during nine months of the year is that of the Mediterranean region, with a generous glow of the tropical sum superadded. During the remaining quarter of the year it is hot and dusty.

In continuation of the reports on tropical fruits which have already appeared in previous numbers of the *Kew Bulletin*, Mr. Cameron has been good enough to communicate the following notes on the fruits of Mysore, but with more especial reference to those growing in the neighbourhood of Bangalore:—

ANONACEÆ.

Anona muricata, the Sour Sop; *A. reticulata*, the Custard Apple or Bullock's-heart; and *A. squamosa*, the Sweet Sop, are generally grown in Mysore. The Cherimoyer, *Anona Cherimolia,* has been sucessfully introduced to Southern India, but it has not yet been grown at Bangalore.

GUTTIFERÆ

Ochrocarpus longifolius (Flora British Ind. vol. 1, p. 270) yields a fruit which deserves to be better known. It is a middling-sized tree with flowers two thirds of an inch in diameter. The fruit about an inch long, is obliquely ovoid, tipped by the hard-pointed style. [Specimens of this fruit have lately been forwarded by Mr. Cameron to the Kew Museum.]

Garcinia Mangostana, the celebrated Mangosteen of the Malayan Archipelago does not succeed in the climate of Bangalore.

MALVACEÆ.

Hibiscus Sabdariffa, the Rozelle or Sorrel, yields from the succulent calyx an agreeable acid juice which is much used in preserves.

STERCULIACEÆ.

Guazuma tomentosa. This tropical American tree is widely distributed in India. Children are fond of the tubercled capsule, which resembles a mulberry. Cattle are fond of the leaves and fruit also.

MALPIGHIACEÆ.

Malpighia punicifolia, known as the Barbados Cherry, and *Malpighia glabra*, called the Surinam Cherry, are sparingly grown in Mysore, but are very rarely used. The former, especially, might be used as in the West Indies for making jams or candied with sugar.

GERANIACEÆ.

Averrhoa Carambola, known as the Kómarac, is a garden plant of considerable value. We have three varieties at Bangalore. One is comparatively sweet, and the other two are very acid. There are also differences in the size of the fruits as well as in the trees that bear them. The natives are very fond of the fruits, and a few trees in the garden are let out on contract at about 8*l.* yearly.

Averrhoa Bilimbi has a fruit with five rounded lobes. It is used almost exclusively in pickles only.

RUTACEÆ.

Clausena Wampi (*Cookia punctata*) has been recently introduced. The fruit is small and globular, with a tough rind covered with glands full of green balsamic oil.

Triphasia trifoliata. This is a spinous shrubly plant often used for hedges. The small fruits are rarely used.

Feronia elephantum, the Elephant or Wood-apple. The pulp of the fruit is edible.

Ægle Marmelos. This is the well-known Bael tree which bears a fruit varying in size from 2 to 5 inches in diameter. The rind is grey, and the pulp, considered valuable in cases of dysentery, is sweet, thick, and orange-coloured. At Bangalore there are two well-marked varieties, the large fruited and small fruited.

Citrus decumana, or Pumelo. We have four varieties of this fruit in addition to the Amoy pumelo recently introduced. The large pink-fleshed varieties are most esteemed.

Citrus Aurantium. The orange succeeds well on the hills of Mysore, but never attains perfection in the plains. There are four or five well-marked varieties of the orange known in cultivation here, including the Coorg and Nagpur oranges, which are considered the best. The St. Michael's orange is said to have been recently introduced, but I much doubt if it is true to name.

Citrus Medica. There are three varieties of the Citron known here.

Citrus Medica, var. **acida.** This is the Sour Lime of India. There are four or five kinds of the sour lime, some of which are cultivated in every town and hamlet. The fruit is offered by the Hindoos to their friends as an emblem of friendship.

Citrus Medica, var. **Limonum.** There are two well-marked Lemons known here in addition to the Malta Lemon recently introduced. We have also small plants labelled "Jamaica Lemons."

Citrus Medica, var. **Limetta.** Of the Sweet Lime we have two kinds distinguished as the round and oval.

RHAMNEÆ.

Zizyphus Jujuba. Bhere fruit. The natives appear to like this fruit, of which there are several varieties. These are distinguished by the shape of the fruit, which may be either globose or oblong. [In the *Flora of British India*, Vol. I. p. 633, it is stated that there are many cultivated varieties of *Zizyphus Jujuba*, differing greatly in the shape and size of the leaves, as also in the size and nature of the fruit, of which the most remarkable is Edgeworth's variety, *Hysudricus* (*Journ. Linn. Soc.*, vi. 201), with erect or spreading, not drooping, branches, obtuse, ovate, oblong, or orbicular leaves, glabrous, or slightly tomentose beneath, and long petioles. This, according to Aitchison, is always raised by grafts. Two other varieties are described by Edgeworth, viz., *hortensis* and *spontaneus*.]

AMPELIDEÆ.

Vitis vinifera. The Grape. There are about six varieties of the grape vine under cultivation in Mysore, including the Black Hamburg, the White Frontignan, and the Auremgabad. The latter is perhaps the best of all, but it is very liable to blight. The system of bush training practised in France has been successfully tried by a cultivator some miles from Bangalore. With suitable varieties, adapted to the soil and climate, I see no reason why India should not be able to grow her own wine. I have recently written home for a selection of the best hot-house varieties, for trial in the open air.

Vitis indica. This is an indigenous grape vine, with slender woolly stems. The fruit is globose, the size of a large currant. It is eaten only by the hill tribes.

Vitis Martini. Cochin China Vine. This is a deciduous vine, recently introduced. [See *Kew Bulletin*, vol. ii., 1888, p. 134.]

SAPINDACEÆ.

Nephelium Lit-chi. The Lit-chi. Although widely cultivated in India, this fruit is only found in a few gardens in the neighbourhood of Bangalore at present. It is an excellent fruit, and worthy of general cultivation.

Nephelium Longana. Although a native tree, it is also often cultivated. The fruit is reddish or purple, globose, about ¾ inch in diameter, and, like the Lit-chi, it posseses a wholesome edible aril.

ANACARDIACEÆ.

Spondias mangifera. Hog-plum of Europeans and Amra of the Hindoos. This is a drupaceous fruit 1½–2 inches long, yellow, smooth; the flesh is austere, and on this account it is rarely used as a dessert fruit. The natives usually parboil it with other ingredients of their food. A species of *Spondias*, whose name is unknown, has a larger fruit than the Hog-plum. In other respects it is very similar.

Anacardium occidentale. Cashew nut. The kidney-shaped nut is generally used roasted. The pyriform fleshy receptacle about 2–3 inches long has a pleasant acid astringent flavour, which is liked by many people.

Mangifera indica. The Mango. This fruit in India has been greatly improved during the past quarter of a century by the process known as inarching, and, during the last two hundred years, by careful selection of seed. The seedling plants run to endless varieties as affected by cross-fertilization, soil, and climate. In most parts of the country the best of these are now fixed by the process of inarching. The names given to good kinds are usually derived from the places where they are grown or have reference to the persons who were concerned with them. In addition to a large number of varieties, we have the following named sorts at Bangalore :—

Alfonso, a small-fruited kind from the Portuguese settlement of Goa.

Bangalore, a small fruited mango associated with this district.

Goa, a large fruited mango, considered one of the best.

Baradeen, introduced from Chitoor. It is a long fruited mango, pointed at both ends.

Salem, called after the town of that name, and esteemed as a good fruit.

Oothamarencemara, one of the largest mangoes.

Raspberry, so named perhaps on account of its colour, which is a bright rosy red on one side when ripe.

Badami, is an almond-flavoured mango.

Peter, *Thillpassand*, *Dudipada*, *Gathaymar*, and *Chittoor* are very superior mangoes grown at such places as Bombay, Malda, Mogazon, Chittoor, Salem, and Bangalore, but when removed from their native localities these celebrated varieties often lose their best qualities.

LEGUMINOSÆ.

Arachis hypogæa. Ground-nut. Being a common field crop the ground-nut is much eaten by the natives. Roasted, they are a good substitute for the almond.

Pithecolobium dulce. This is a native of Tropical America cultivated in India often as a hedge plant. The pod is 4–5 inches long inside of which the seeds are enveloped in a pulpy white edible aril. This pulpy aril is eaten by the poorer classes.

Ceratonia Siliqua. The Carob tree. The trees in the Lal Bagh fruit freely.

ROSACEÆ.

Prunus Persica. The Peach. The peaches in this country are vastly inferior in size and flavour to the fruit grown under glass in Europe. Varieties such as the Noblesse and Barrington have been tried, and although the plants flourish fairly well they have never, as far as I am aware, borne fruit. Experiments are in course of being tried to graft choice sorts on naturalised stocks. Our present supplies of peach fruits are maintained from an inferior sort called the "country peach," and from a variety known as the "Indore peach." The nectarine (which is regarded as a form of peach with a smooth and not downy skin) is also grown, and fruits freely.

Prunus Armeniaca. The Apricot. The apricot is cultivated and almost naturalised in mountainous parts of India. It succeeds also in the hills around Bangalore.

Prunus communis. The Plum. Two varieties known as Keikes and Magnum Bonum are principally under cultivation here. They succeed only fairly well.

Rubus rosæfolius? There is here a cultivated bramble which is neither the blackberry nor the raspberry. It seems to be intermediate between these two. When the plants are well managed the fruit is excellent.

Fragaria vesca. The Strawberry. There are several varieties of the Strawberry under cultivation, one from Australia being the most prized at present. The Strawberry plant has to be treated as an annual on the plains of India, otherwise its produce would scarcely be worth collecting in the second year. We plant out strong off-sets in August which begin to fruit in the following January or six months from the time of planting. The fruiting season is usually over by the middle of March.

Eriobotrys japonica. The Loquat. There are two varieties of this plant, one recently introduced from the north of India yields an excellent fruit.

Pyrus communis. Pear. As a dessert fruit the Pear is said to attain a certain degree of perfection at Ootacamund. Here we have only two varieties of a tasteless cooking pear.

Pyrus Malus. Apple. A good many native families make their living by growing apples in this district. It is surprising to see what excellent fruit they raise from small stunted bushes, native grown. Apples when very scarce sell at the rate of about Rs. 3 to Rs. 4 per dozen (4*s.* 6*d.* to 6*s.* per dozen). The plants never become trees, as may easily be imagined when the natives plant them only 4–5 feet apart. There are about 20 varieties, including Ribston Pippin, Dutch Codlin, and other well-known kinds. Amongst the natives they are universally known by their numbers only.

COMBRETACEÆ.

Terminalia Catappa. Country Almond. The large almond-like seeds, are eaten both in the raw state and roasted. In the latter condition they are very palatable and afford a good substitute for almonds.

MYRTACEÆ.

Psidium Guyava. Guava. This is naturalised throughout India. There are two well-marked varieties: var. *pyriferum* with one-flowered penduncles and fruit pear-shaped; var. *pomiferum*, with two or three flowered penduncles and fruit globose or ovoid. The process of inarching has done much to improve this fruit, of which there are under cultivation several varieties. Indians and Eurasians are exceedingly fond of this fruit, which they often eat when quite green.

Eugenia Jambos. Rose apple. The flowers of this are large and white, while the fruit is sub-globose and slightly scented.

Eugenia malaccensis. Malay apple. The flowers of this are red. The fruit is oval and of a beautiful rosy-pink colour. There are several varieties under cultivation, of which one has an avoid dark purple fruit.

Eugenia myrtifolia. This is a shrub or small tree which yields a small and palatable fruit.

Eugenia Jambolana. Jamoon. There are several varieties of this fruit, varying in size from that of a pea to a pigeon's egg. The best is that with large fruits usually produced in fine clusters. A model of the latter may have been observed at the Indian Court of the Colonial and Indian Exhibition of 1886. The tree attains a large size, and is usually found in village topes as well as at road-sides.

LYTHRACEÆ.

Punica Granatum. Pomegranate. This fruit is much prized by Mahommedans, and is chiefly cultivated by them. There are four varieties, of which the large red is considered the best.

CACTEÆ.

Opuntia, spp. Prickly Pears. There are several kinds of Prickly Pears grown in India for the sake of the fruits. Some plants (possibly *Opuntia Ficus-indica*) have lately been brought from Malta. [On Prickly Pears in India and the principal species cultivated in the Mediterranean region see *Kew Bulletin*, 1888, pp. 170–171.]

RUBIACEÆ.

Canthium parviflorum. This is a rigid shrub covered with stout straight spines. The fruit has an agreeable acid taste, and is eaten by children.

SAPOTACEÆ.

Achras Sapota. Sapodilla-plum. This West Indian fruit tree is only cultivated so far in the Botanical Gardens. There are two varieties, viz., the round and oval-fruited Sapodilla.

OLEACEÆ.

Olea europæa. The Olive. This has been cultivated in the Botanic Gardens for 20 years, but has never fruited.

APOCYNACEÆ.

Carissa Carandas. Karinda. The fruit of this small tree is a drupe ½–1 inch long, at first red, then black and polished. In the wild state it is not unpleasant, and it might be improved and rendered of great value by cultivation.

SOLANACEÆ.

Cyphomandra betacea. Tree-tomato. This valuable introduction to Southern India (*Kew Bulletin*, August 1888, p. 2) has been established at Bangalore and fruited several times. On the Nilgiris also it has been very successful, and the fruit pronounced "most delicious." Directions for the treatment of the plant and various ways for using the fruit are contained in the recently issued volume of the *Proceedings Agri-Horticultural Society of Madras* (New Series, Vol. iv., 1885–86–87).

LAURINEÆ.

Persea gratissima. Alligator Pear. This is a comparatively rare plant under cultivation here.

EUPHORBIACEÆ.

Antidesma sp. A plant of this genus, whose specific name I am unable to determine, affords a berried fruit resembling a miniature apple.

Cicca disticha. Star-gooseberry. The fruits of this tree are like those of the gooseberry, three or five-furrowed and some acid and cooling. They are used either in a raw state or cooked in various ways.

Phyllanthus Emblica. This is a tree sometimes of large growth. The fruit is obscurely six-lobed, and resembles a gooseberry. It is exceedingly acid, and is used in pickles and preserves.

URTICACEÆ.

Artocarpus incisa. Bread-fruit. We have two varieties of the bread-fruit, the seeding and the seedless. The latter flourishes on the western coast, but is not likely to succeed on the inland plains of India. Of the seeding fruit there are several sub-varieties, one of which fruits regularly at Bangalore.

Antocarpus integrifolia. Jack-fruit. The Hindoos are exceedingly fond of this fruit, of which there are numerous local varieties. A native nobleman (the Jaghirdar of Arnee) cultivates 40 distinct varieties of Jack-fruit, each tree being carefully numbered according to the quality of the fruit yielded by it. The fruits which grow upon the root-stock are highly prized. A large-sized Jack-tree in full bearing is one of the grandest sights in the vegetable kingdom.

Morus alba. White Mulberry.
Morus nigra. Black Mulberry.
Morus indica. Indian Mulberry.
Morus japonica. Large-fruited Mulberry.

All these are sparingly cultivated for the sake of their fruits, but the first, second, and third are extensively grown for feeding silkworms.

Ficus Carica. Fig. There are several varieties of figs grown in India, but none of them attain that degree of perfection which the climate would seem to indicate. The fig is one of the dessert fruits regularly and almost exclusively grown for the European population at Indian stations. When well-ripened the good varieties are far preferable to any preserved figs I have ever tasted.

Ficus glomerata. Country Fig. This is a native species, which yields an abundant quantity of an inferior fruit. It is eaten only by the hungry and poor.

Ficus Roxburghii. This is another native fig, but the fruit is not much eaten.

SCITAMINEÆ.

Musa sapientum. Plaintain [or Banana]. Of all the fruits grown in India this is the most prolific and most useful. There are numerous varieties, of which the following are the vernacular names of the most prominent in this district :—

Yáláki bále	Large-fruited plantain.
Ælle bále	The foliage plantain.
Gulur bále	Small butter plantain.
Gulur dodda bále	Large butter plantain.
Rasa bále	Custard plantain.
Havu bále	Snake plantain.
Putta bále	Guindy plantain.
Chanava bále	Red plantain.
Jain bále	Honey plantain.
Raja bále	Custard plantain.
Pacha bále	Large green plantain.
Yalaki bále	The small plantain.

BROMELIACEÆ.

Ananas sativa. Pine-apple. This succeeds fairly well with careful and rich treatment. We are in want of the best varieties.

PALMÆ.

Cocos nucifera. Cocoa-nut. At an elevation of 3,000 feet and 200 miles from the sea the Cocoa-nut palm is scarcely worth cultivating. It is, however, here and there in several varieties. [In other parts of Mysore, especially when water is near the surface, the cultivation of the Cocoa-nut is said to be fairly profitable. The export of fresh Cocoa-nuts from Mysore State in 1880–81 was valued at 10,452*l*., and of Cocoa-nut oil at 666*l*. *Imp. Gaz. of India*, vol. x. p. 102.]

Phœnix dactylifera. Date-palm. This has only been recently introduced. The Wild Date (*Phœnix sylvestris*), on account of the toddy yielded by it, is one of the most valuable trees in Mysore.

Since the above information was prepared by Mr. Cameron there has been issued the Annual Report on the Government Botanical Gardens at Bangalore for 1887–88 which contains much useful information.

It appears that the Tree-tomato, *Cyphomandra betacea*, the Arracacha, *Arracacia esculenta*, and the Cho-cho, *Sechium edule*, three very important food plants introduced to the East Indies through the instrumentality of Kew and the Botanical Gardens at Jamaica, have now been successfully established at Bangalore. Various new varieties of grape vines, apples, apricots, nectarines, peaches, plums, raspberries, and the Spanish chestnut, have been introduced during the past year, and these it is proposed to cultivate in the Palace Gardens. It is stated that 690 off-sets of the date palm and 164 pounds of date palm seed had been received. The result of experimental cultivation of this plant so far has not proved satisfactory. Some of the off-sets received from the Persian Gulf cultivated in the garden afford some hope of doing better in the future.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 26.] FEBRUARY. [1889.

SEEDS OF HERBACEOUS PLANTS.

The following is a list of such Hardy Herbaceous Annual and Perennial Plants as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1888. These seeds are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. The seeds are for the most part only available in moderate quantity, and are not sold to the general public.

As compared with the list previously published (*Kew Bulletin*, February 1887), it will be noticed that the number of names inserted in this list is far fewer. This has arisen on account of the unfavourable conditions experienced during the summer of 1888, when, owing to prolonged rains and absence of sunlight, many plants did not mature seed. The list has been now arranged in alphabetical order: this it is hoped will render it more convenient for purposes of reference.

Every effort has been made to correctly determine the nomenclature of the plants in the list. As far as it goes it serves as a record of the Herbaceous species cultivated at Kew, which have matured seed during the past year. It must be remembered, however, that a considerable proportion of herbaceous plants grown at Kew, as already explained, cannot be included in the present list.

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Price Twopence.

Acæna argentea, Ruiz et Pavon, Chili.
microphylla, Hk. fil., N. Zealand.
myriophylla, Ldl., Chili.
ovalifolia, Ruiz et Pavon, Peru (Ancistrum repens, Vent.)
sanguisorbæ, Vahl, New Zeal.

Acantholimon glumaceum, Boiss., Orient.

Acanthus longifolius, Host, S. Eur.

Achillea Ageratum, L., Eur.
decolorans, Schrad., Eur.
filipendulina, Lam., Orient.
— var. Eupatorium, Bbrst.
Gerberi, Willd., Siber., Caucas.
ligustica, All., S. Eur.
Millefolium, L., Eur.
— var. rubrum.
pallescens, DC., Asia Minor.
Ptarmica, L., Eur.
tomentosa, L., Eur.
umbellata, S. & S., Greece.

Aconitum Fischeri, Rchb., Kamtsch.
— var. acutum.
heterophyllum, Wall, India.
Lycoctonum, L., Eur., etc.
— var. Kusnezoffii, Reichb.
— var. ochranthum.
Napellus, L., Eur., Temp. Asia.
— var.
volubile, Pall., Siberia.

Acroglochin chenopodioides, Schrad., W. Himal.

Actæa spicata, L., Eur., Asia.
— var. fructu-albo.
— — — rubro.

Actinolepis coronaria, Gray, Calif. (Hymenoxys californica, Hook. Bæria coronaria, Gray. Shortia californica, Hort.)

Actinomeris squarrosa, Nutt., N. Amer. (A. alternifolius, DC. A. helianthoides, Nutt.)

Adenophora liliifolia, Bess., Hungary, etc.
(A. suaveolens, Fisch.)

Adesmia muricata, DC., Chili, Patag.

Adlumia cirrhosa, Raf., Unit. States.

Adonis flammea, Jacq., Eur.

Ægopodium Podagraria, L., Eur., etc.
— var. fol. varieg.

Ægopogon pusillus, Beauv., Mexico.

Æthionema graecum, B.S., Greece.
heterocarpum, Gay, Syria.
saxatile, R.Br., S. Eur.

Æthusa Cynapium, L., Eur.

Ageratum conyzoides, L., N. Amer.

Agrimonia Eupatoria, L., Eur., etc.

Agropyrum caninum, Beauv., Eur. (Triticum caninum, Schreb.)
muricatum, Schult., Eur. (T. muricatum, Link.)
junceum, Beauv., Eur., etc. (T. junceum, L.)
repens, Beauv., Eur., etc. (T. repens, L.)
— var. aristatum.

Agrostis alba, L., Eur.
— var. stolonifera, (L.)
dispar, Michx., N. Amer.
vulgaris, With., Eur.
— var. foliis variegatis.

Ainsworthia cordata, Boiss., Asia Minor.

Ajuga alpina, L. Eur.
Chamæpitys, Schreb., Eur., etc.
glabra, Presl. Mediter.
pyramidalis, L., Eur.

Alchemilla alpina, L. Eur.
argentea, Don., Eur. (A. conjuncta, Bab.)
arvensis, Lam., Eur.
fissa, Günth., Eur.

Alisma Plantago, L., Eur.

Allium Ampeloprasum, L., Eur.
angulosum, L., Siberia.
— var. acutangulum, (Schrad.)
atropurpureum, W. et K., Hungary.
fistulosum, L., Siberia.
giganteum, Regel., Siber.
hymenorrhizum, Ledeb., Siberia.

Allium—*cont.*
— var. tenuifolium, Regl.
Ledebourianum, R. et S., Siberia.
macranthum, Baker., Himal.
Moly, L., Eur., etc.
narcissiflorum, Vill., Eur.
neapolitanum, Cyril., Italy, etc.
odorum, L., Siberia.
oleraceum, L., Eur.
(A. complanatum, Bor.)
Ostrowskianum, Regel., Turkestan.
pedemontanum, Willd., Eur.
polyphyllum, Kar. et Kir., Siberia.
Porrum, L., S. Eur.
pulchellum, Don, S. Eur., etc.
— var. flavum, Reg., S. Eur.
roseum, L., S. Eur.
— var. carneum, Reichb.
Schœnoprasum, L., Eur.
— var. sibiricum, (L.)
Scordoprasum, L., Eur.
senescens, L., Eur., Siber.
siculum, Ucria., Sicily, etc.
sphærocephalum, L., Eur.
— var. Deseglesei, (Bor.)
subhirsutum, L., S. Eur., etc.
urceolatum, Regel, Turkestan.
ursinum, L., Eur.
vernale, Tineo, Sicily.
Victorialis, L., Eur., Siber., etc.

Alonsoa caulialata, R.P., Peru.
grandiflora, Hort., Peru.
Warscewiczii, Rgl., Peru.

Alopecurus agrestis, L., Eur., Caucas.
nigricans, Hornem., Eur.
pratensis, L., Eur.
— var. fol. variegatis.
utriculatus, Schrad., Eur.

Alstrœmeria aurantiaca, Don, Chili.
hæmantha, R. et P., Chili.

Althæa narbonensis, Pourr., Eur.
rosea, Cav., Orient.
— var.
— var. Heldreichii, (Boiss.)

Alyssum libyca (R. Br.), Spain.
minimum, Willd., Eur.
pyrenaicum, Lap., Pyrenees.

Alyssum—*cont.*
saxatile, L., Russia.
turkomanicum, Reg. et Sch., Turkestan.
Wierzbeckii, Heuffl., S. Eur.

Amaranthus chlorostachys, Willd., India.
hypochondriacus, L., Amer., etc.
— var. caudatus, (L.)
— var. speciosus, (Don.)
lividus, L., N. Amer., etc.
paniculatus, L., India, etc.
retroflexus, L., Amer., etc.

Amellus strigosus, Less., var. Willdenovii, Harv., Cape. (A. annuus, Willd.)

Amethystea cœrulea, L., Siber.

Ammi glaucifolium, L., S. Eur.

Ammobium alatum, R.Br., Australia.

Ampelodesmus tenax, Link., Eur.

Amsinckia intermedia, Fisch. et Mey., Calif.

Anacyclus clavatus, Pers., Eur.

Anagallis arvensis, L., Eur., etc.
— var. carnea, (Schrank.)
— var. cœrulea, (Schreb.)

Anaphalis Royleana, DC., var. concolor, Royl., Ind., Or.

Anchusa capensis, Thunb., Cape.
italica, Retz., S. Eur., etc.

Andromeda polifolia, L., Eur.

Andropogon furcatus, Mhlbrg., N. Amer.
scoparius, Michx., N. Amer.

Androsace filiformis, Retz., Siber.
sarmentosa, Wall., India.

Andryala lanata, L., S. Eur., etc.

Anemone apennina, L., Eur.
coronaria, L., S. Eur., etc.
decapetala, L., N. Amer.
fulgens, Gay, S. Eur.
multifida, Poir., N. Amer.
—var. Hudsoniana (Richards.).
pennsylvanica, L., N. Amer.
polyantha, Don, Himal.
Pulsatilla, L., Eur., etc.
rivularis, Buchan., Himal.
trifolia, L., Eur., etc.

Anemone—*cont.*
sylvestris, L., Eur.
virginiana, L., N. Amer.

Anethum Sowa, Roxb., India.

Angelica dahurica, Fisch., Dahur.

Anoda crenatiflora, Orteg., Mexico.
hastata, Cav., N. Amer.
Wrightii, Gray, Mexico.

Antennaria dioica, Gærtn., Eur., etc.
— var. tomentosa.
plantaginifolia, Hook., N. Amer.

Anthemis granatensis, Boiss., Spain.
mixta, L., Eur., (Ormenis, Cass.)
nobilis, L., Eur.
— var. discoidalis.
tinctoria, L., Eur.
— var. pallida.

Anthericum Liliago, L., S. Eur., N. Afr.
— var. algeriense, (Boiss.)
— var. Dorseti, Hort.
ramosum, L., Eur.

Anthoxanthum odoratum, L., Eur.

Anthriscus Cerefolium, Hoffm., Eur.
nemorosa, Spr., Caucas, etc.

Antirrhinum Nuttallianum, Bth., Calif.
Orontium, L., Eur.
rupestre, Boiss. et Reut., Spain.

Apera Spica-venti, Beauv., Eur. (Agrostis Spica-venti, L.)

Aphanostephus ramosissimus, DC., Mexico.

Apium graveolens, L., Eur., etc.

Aquilegia atrata, Koch., Alps.
Bertolonii, Schott., Ital.
chrysantha, Gray, N. Amer.
— var.
cœrulea, Torr., N. Amer.
Rauwolfii, Hort., var. aurea.
sibirica, Lam., Siberia.
— var. alba, Hort.
— var. Bungei, Hort.
thalictrifolia, Sch. et Kotch., Tyrol.
vulgaris, L., Eur.

Aquilega—*cont.*
— var. alba, Hort.
— var. Kitaibelii.
— var. monstrosa, Hort.

Arabis albida, Stev., Caucas.
— var.
alpina, L., Eur., N. Afr.
cenisia, Reichb., S. Eur.
lilacina, Schrad., N. Amer.
petræa, Crantz, Eur.
pumila, Wulf., S. Eur.
rosea, DC., Calabr.
saxatilis, All., Eur.
Soyeri, B. et R., Pyrenees.
Stelleri, DC., China, etc. (A. japonica, Gray.)
sudetica, Tausch., Centr. Eur.
Turczaninowi, Led., Siberi.

Archangelica officinalis, Hoffm., Eur.

Arctium minus, Schk., Eur. (Lappa minor, DC.)

Arctotis revoluta, Jacq., Cape. (A. Leichtlinii, Lynch.) (A. speciosa, Jacq.)

Arenaria balearica, L., Balearic Isles.
graminifolia, Schrad., S. Eur.
— var. multiflora.
— var. parviflora.
gypsophiloides, Schreb., Orient.
hirta, Worsmsk., Eur.
laricifolia, L., Eur.
pinifolia, Bbrst., Caucas.

Argemone mexicana, L., Mexico.
— var.
— var. alba.

Armeria alliacea, Willd., Eur., etc.
canescens, Boiss., Dalmatia.
longiaristata, B. & R., Orient.
maritima, Willd., Eur.
— var. alba.
— var. Laucheana.
plantaginea, Willd., Eur.
— var. alba.
— var. leucantha, Boiss.
purpurea, Koch., Eur.
sibirica, Turcz., Siber.
vulgaris, Willd., Eur.
— var. rubra.

Arnica amplexicaulis, Nutt., N. Amer.

Arnica—*cont.*
montana, L., Eur.
Chamissonis, Less., N. Amer.

Arracacia arguta (T. & G.), N. Amer.

Arrhenatherum avenaceum, Beauv., Eur.

Artemisia discolor, Dougl., N. Amer.
Ludoviciana, Nutt., N. Amer.
— var. gnaphalioides, (Nutt.)
Messerschmidtiana, Besser, Siber.
parviflora, Roxb., India.

Arum italicum, Mill., Eur.
orientale, Bbrst., Caucas, etc.

Arundo conspicua Forst., New Zeal. (Calamagrostis conspicua, Gmel.)

Asarum canadense, L., N. Amer.
europæum, L., Eur.
virginicum, L., N. Amer.

Asparagus officinalis, L., Eur.

Asperugo procumbens, L., Eur.

Asperula hexaphylla, All., Italy, etc.
longifolia, Sibth., Thrace, etc.
tinctoria, L., Eur.

Asphodelus albus, Willd., Eur.
— var. æstivus, (Brot.)
ramosus, L., S. Eur.

Aster acris, L., Eur. (Galatella acris Nees.)
— var. punctatus, (DC.)
acuminatus, Michx., N. Amer.
alpinus, L., Eur.
Bigelovii, Gray, New Mexico.
(A. Townshendii, Hk. fil.)
corymbosus, Ait., N. Amer.
dahuricus, Benth., Dahuria.
(G. dahurica, DC.)
glaucus, T. et Gr., Rocky Mountains.
Herveyi, Gray, N. Amer.
lævis, L., N. Amer.
— var. 2.
longifolius, Lam., N. Amer.
macrophyllus, L., N. Amer.
Novi-Belgii, L., N. Amer.
— var. densus, Hort., Kew.
— var. niveus, Hort., Kew.

Aster—*cont.*
patulus, Lam., N. Amer.
peregrinus, Pursh., N. Amer., etc.
prenanthoides, Muhl., N. Amer.
pseudo-amellus, Hk. fil., Himal., 13,000 ft.
puniceus, L., N. Amer.
— var. lucidulus, Gray.
(A. p. vimineus, T. et Gr.)
Radula, Ait., N. Amer.
salicifolius, Ait., N. Amer.
— var.
sibiricus, L., Siberia, etc.
spectabilis, Ait., N. Amer.
Stracheyi, Hk. fil., Himal.
tanacetifolius, H.B.K., Texas, etc.
Thomsoni, Clarke, Himal.
tricephalus, C. B. Clarke, Himalayas.
trinervis, Desf., Eur.
— var. minor. (Galatella rigida, Cass.)
umbellatus, Mill., N. Amer.

Asterolinum stellatum, Link, Eur.

Astilbe decandra, Don., N. Carolina, etc.
japonica, Miq., Japan.
(Hoteia japonica, M. et D.)
(Spiræa japonica, Hort.)
rivularis, Don., E. Ind.
rubra, Hk. f. et Th., Himal.

Astragalus aduncus, Willd., Caucas.
ægyptiacus, Spr., Egypt.
chinensis, L., China.
chlorostachys, Ldl., Himal.
Cicer, L., Eur.
falcatus, Lam., Siberia.
glycyphyllus, L., Eur.
pannosus, Fenzl., Taur., etc.
stipulatus, Don., Nepal.
sulcatus, L., Siber., Taur.
thianshanicus, Regl., Turkes.

Astrantia Biebersteinii, F. et M., Caucas.
major, L., Eur., etc.
— var. carinthiaca, (Hoppe.)
— var. pauciflora, (Bertol.)

Atractylis cancellata, L., Mediter.

Atriplex hortensis, L., N. Asia.
— var. rubra, Hort.

Atriplex—*cont.*
laciniata, L. Eur., etc.
ruberrima, Hort.
sibirica, L., Siberia, (Obione sibirica, Fisch.)
tatarica, L., Eur. (A. oblongifolia, W. et K.)

Atropa Belladonna, L., Eur.

Aubrietia deltoidea, DC., S. Eur.
— var. græca, (Griseb.)
— var. grandiflora.
— var. purpurea.

Avellinia Michelii, Parl., Eur.

Avena sativa, L., S. Eur.
strigosa, Schreb., Eur.

Bæria chrysostoma, Fisch. et Meyer., Calif.
gracilis, Gray, Calif.

Bahia lanata, DC., N. Amer. (Eriophyllum cæspitosum, Dougl.)

Baptisia australis, R. Br., N. Amer.

Beckmannia erucæformis, Host, Eur., etc.

Beta maritima, L., Eur.
orientalis, Heyne, India, etc. (B. benghalensis, Roxb.)
trigyna, W. et K., E. Eur.
vulgaris, L., Eur., Afr., etc.

Bidens frondosa, L., N. Amer.
leucantha, Willd., N. Amer., etc.
procera, Don., Mexico.

Biserrula Pelecinus, L., S. Eur., etc.

Biscutella ciliata, DC., S. Eur.
didyma, L., S. Eur.
erigerifolia, DC., Spain.

Blitum (*see* Chenopodium).

Blumenbachia Hieronymi, Urban, S. Amer.
insignis, Schrad., Monte Video.

Bocconia cordata, W., China.

Brachycome diversifolia, F. et M., Australia.

Brachypodium distachyum, R. et S., Medit.
pinnatum, Beauv., Eur.

Brassica alba, Boiss., Eur.
balearica, Rich., Ins. Balear.

Brassica—*cont.*
campestris, L., Eur., etc. (B. chinensis, L.)
— var. cernua, (Thunb.)
— var. serotina.
— var. Shantung Cabbage.
Cheiranthus, Vill., S. Eur.
elata, Ball., N. Afr.
Eruca, L., S. Eur.
Erucastrum, Vill., S. Eur.
Napus, L., Eur.
nigra, Koch, Eur.
oleracea, L., Eur.
— var. capitata.
— var. Jersey kale.
Rapa, L., Eur.
rugosa, Roxb., Thibet.
Tournefortii, Gouan, Spain, etc.

Braya alpina, Sternb., Alps.

Briza maxima, L., Eur.
minor, L., Eur.

Bromus arvensis, L., Eur.
Biebersteinii, R. et S., Caucas.
breviaristatus, Thurb., N. Amer.
ciliatus, L., N. Amer. (B. canadensis, Michx., B. purgans L.)
erectus, Huds., Eur., etc.
inermis, L., Eur., etc.
madritensis, L., Eur.
maximus, Desf., Eur.
— var. Gussonii, (Parl.)
mollis, L., Eur., etc.
— var. glabrescens, Coss.
patulus, Mert., Eur.
propendens, Jord., Eur.
purgans, L., N. Amer.
sterilis, L., Eur.
Taena, Steud., Chili.

Browallia viscosa, H. B. K., Peru (B. Czerwiakowskyana, (Rgl.)).

Bryonia dioica, L., Eur.

Bulbine annua, Willd., Cape.

Bulbocodium vernum, L., Eur.

Bunias Erucago, L., S. Eur.

Bupleurum Candollei, Wall., Himal.
longifolium, L., Temp., Eur.

Bupleurum—*cont.*
prostratum, Ledeb., Siber.
ranunculoides, L., Eur.
rotundifolium, L., Eur.
semicompositum, L., S. Eur.

Butomus umbellatus, L., Eur.

Calais (*see* Microseris).

Calamagrostis Epigeios, Roth, Eur.
lanceolata, Roth, Eur.
lapponica, Trin., Eur.
varia, Trin., Eur., etc.

Calamintha Clinopodium, Bth., Eur.
grandiflora, Lam., S. Eur.
umbrosa, Reichb., S. Eur.

Calandrinia glauca, Schrad., Chili.
Menziesii, Hook., Oregon.
pilosiuscula, DC., Chili.
umbellata, DC., Chili.

Calceolaria chelidonoides, H.B.K., Chili.

Calendula arvensis, L., Eur.
hybrida, L., S. Eur.
officinalis, L., S. Eur.

Calliopsis (*see* Coreopsis).

Callirhoe pedata, Gray, N. Amer.

Caltha palustris, L., Eur., etc.
— var. minor, Syme.
radicans, Forster, Eur., etc.

Camassia esculenta, Ldl., N. Amer.
Leichtlinii, Wats., N. Amer.

Camelina sativa, Crantz, Eur., etc.

Campanula alliariæfolia, Willd., Caucas.
carpathica, L. fil., Carpath.
— var. alba.
collina, Bbrst., Caucas.
Erinus, L., Eur.
glomerata, L., Eur., etc.
lactiflora, Bbrst., Caucas.
— var. cœrulea.
latifolia, L., Eur., etc.
— var. macrantha, (Fisch.)
— var. versicolor, (Sib. et Sm.)
latiloba, DC., Olympus. (C. nobilis, Hort.)
persicifolia, L., Eur., etc.
— var. alba.
— var. maxima.
primulæfolia, Brot., Spain.
punctata, Lam., Siber., etc.

Campanula—*cont.*
rapunculoides, L., Eur.
Reuteriana, B. et B., Orient.
rhomboidea, L., Eur.
Trachelium, L., Eur.

Carbenia benedicta, Benth., Eur.

Cardamine chelidonia, L., Eur.
Ludoviciana, Hook., N. Amer.

Carduus stenolepis, (K. et K.), Siber.

Carex acuta, L., Eur.
adusta, Boott, N. Amer.
arenaria, L., Eur.
baldensis, L., Eur.
binervis, Sm., Eur.
depauperata, Good., Eur.
distans, L., Eur.
divulsa, Good., Eur.
flava, L., Eur., etc.
— var. Oederi, (Ehrh.)
glauca, Murr., Eur.
Grayii, Carey, N. Amer.
hordeiformis, Whlbrg., Eur. Cauc. (C. hordeistichos, Vill.)
lagopodioides, Schk., N. Amer.
Linkii, Willd., Mediter.
paniculata, L., Eur.
pendula, Huds., Eur. (C. maxima, Scop.)
punctata, Gaud., Eur.
remota, L., Eur.
riparia, Curtis, Eur.
sylvatica, Huds., Eur.
vulgaris, Fries, N. Amer., etc.
vulpina, L., Eur.

Carpoceras sibiricum, Boiss., Siber.

Carrichtera Vella, DC., Eur.

Carum Carui, L., Eur.
burjacticum, Turcz., Siber.

Catabrosa aquatica, Beauv., Eur.

Catananche lutea, L., Italy, etc.
— var. alba.

Caucalis grandiflora, L., Eur.
latifolia, L., Eur. (Turgenia latifolia, Hoffm.)
leptophylla, L., S. Eur., etc.
orientalis, L., Orient.

Celsia Arcturus, L., Crete, As. Minor.

Centaurea abyssinica, Sch., Abyss.
calocephala, Willd., S. Eur.
Cyanus, L., Eur.

Centaurea—*cont.*
cynaroides (Less.), Pyrenees.
dealbata, Willd., Caucas.
dissecta, Ten., var. Parlatoris, Heldr., Italy.
helenifolia (G. et G.), S. Eur.
Jacea, L., Eur., etc.
macrocephala, M. et P., Armenia.
montana, L., Eur.
— var. flore albo.
pulchra, (F. et M.), Caucas.
rigidifolia, Bess, Caucas.
Scabiosa, L., Eur.
— var. alba.
— var. Olivieriana, (DC.)
— var. purpurea.
Verutum, L., As. Minor.

Centranthus macrosiphon, Boiss., Grenada.
ruber, DC., Eur.
— var. albus.

Cephalaria procera, Fisch. et Mey., Orient.
tatarica, Schrad., Siberia.

Cerastium alpinum, L., Eur.
arvense, L., Eur.
— var. grandiflorum.
frigidum, Bbrst., Caucas.
— var. collinum.
manticum, L., S. Eur.

Ceratocephalus (*see* Ranunculus).

Ceratochloa unioloides, DC., S. Eur. (Bromus unioloides, H.B.K.)

Chænactis tenuifolia, Nutt., Calif.

Chænostoma fœtida, Benth., Cape.

Chærophyllum aromaticum, Jacq., S. Eur.
bulbosum, L. var. Prescotii, DC., Eur.

Chætanthera Valdiviana, Ph., Chili.

Chamæpeuce (*see* Cnicus).

Charieis heterophylla, Cass, Cape.
— var. rubra.

Cheiranthus Cheiri, L., Eur.

Chelidonium majus, L., Eur.
— var. fl. pl.
— var. laciniatum.

Chelone glabra, L., N. Amer.
Lyoni, Pursh, N. Amer.

Chenopodium album, L., Eur.
Bonus-Henricus, L., Eur.
capitatum, S. Wats., Eur. (Blitum capitatum, L.)
fœtidum, Schrad., Eur.
glaucum, L., Eur.
opulifolium, Schrad., Eur.
Quinoa, L., S. Amer., etc.
urbicum, L., Eur.
virgatum, Benth. et Hook., S. Eur. (Blitum virgatum, L.)
Vulvaria, L., Eur.

Chloris elegans, H.B.K., Mexico.

Chondrilla juncea, L., N. Amer.

Chorispora tenella, DC., Cauc., etc.

Chrysanthemum achilleæfolium, Bbrst., Cauc. (Pyrethrum achilleæfolium Bbrst.)
carinatum, Schousb., N. Afr.
cinerariæfolium, Vis., Dalmatia. (Pyrethrum cinerariæfolium, Trev.)
coronarium, L., S. Eur.
— var. album.
— var. fl. pl.
latifolium, Willd., Eur. (L. latifolium, DC.)
maximum, DC., Pyrenees.
macrophyllum, W. et K., Eur. (Pyrethrum macrophyllum, Willd.)
Parthenifolium, Pers., Eur. (Pyrethrum parthenifolium, Willd.)
— var.
roseum, Adams, Caucas. (P. roseum, Bbrst.)
segetum, L., Eur.
Tchihatcheffii (Regel), Siber. (Pyrethrum.)
viscosum, Desf., Spain.
Zawadskii, Herbich., Eur.

Chrysogonum virginianum, L., N. Amer.

Cimicifuga racemosa, Nutt., N. Amer.

Cinna mexicana, Beauv., Mexico.

Cirsium (*see* Cnicus).

Cistus corbariensis, Pourr., Eur.
platysepalus, Sweet.
villosus, L., Mediter.
— var. albicans.

Clarkia pulchella, Pursh, N. Amer.
— var. alba.
rhomboidea, Dgl., N. Amer.
(C. gauroides, Hort.)

Claytonia perfoliata, Don., N. Amer.
sibirica, L., N. Amer.
(C. alsinoides, Sims.)

Clematis alpina, L., Eur. alba.
(Atragene alpina, L.)
ochroleuca, Ait., N. Amer.
recta, L., Eur., etc.
— var. hispanica, Hort.
— var. pauciflora.

Cleome violacea, L., S. Eur.

Cleonia lusitanica, L., S. Eur., N. Afr.

Clintonia (*see* Downingia).

Cnicus conspicuus, L., Mexico.
heterophyllus, Willd., Eur. (Cirsium heterophyllum, All.)
Kotschyi, Schultz.
(Cirsium lanceolatum, Scop.)
monspessulanus, L., S. Eur. (Cirsium monspessulanum, All.)
munitus, Bbrst., Caucas.
(Cirsium munitum. Bbrst.)
ochroleucus, Willd., Eur. (Cirsium ochroleucum, All.)
oleraceus, L., Eur. (Cirsium oleraceum, All.)
rivularis, Willd., Eur.
strictus, Tenore, Italy, etc.
(Chamæpeuce stricta, DC.)
syriacus, Willd., Medit.
Wallichii, (DC.), Himal.

Cochlearia anglica, L., Eur.
officinalis, L., Eur.

Codonopsis ovata, Bth., Himal.
(Glossocomia ovata, Don.)
lurida, Hort., Kew.

Colchicum speciosum, Stev., Caucas.

Collinsia bicolor, Benth., Calif.
— var. multicolor.
grandiflora, Dougl., N. Amer.
parviflora, Dougl., N. Amer.
violacea, Nutt., N. Amer.

Collomia coccinea, Lehm., Chili.
grandiflora, Dougl., N. Amer.
linearis, Nutt., Calif.
stenosiphon, Kunze, Chili, etc.

Conringia perfoliata, Link, Eur.

Convallaria majalis, L., Eur., Amer.

Convolvulus siculus, L., S. Eur.
tricolor, L., Medit.
— var. albus, Hort.
— var. striatus, Hort.
undulatus, Cav., Medit.

Conyza cardaminæfolia, H. B., Quito.

Coreopsis auriculata, L., N. Amer.
cardaminefolia, Torr. et Gray., Texas.
Douglasii, B. et H., Calif.
(Leptosyne Douglasii, DC.)
grandiflora, Nutt., Georgia.
maritima, Hook., Calif.
(Leptosyne maritima, Gray.)
senifolia, Michx., N. Amer.
tinctoria, Mitt., N. Amer.
— var. bicolor.

Coriandrum sativum, L., Eur., etc.

Corispermum hyssopifolium, L., S. Eur.

Coronilla vaginalis, Lam., S. Eur.

Cortusa Matthioli, L., Eur.
— var. grandiflora.

Corydalis capnoides, Pers., S. Eur.
glauca, Pursh., Unit. States.
— var. rosea.
lutea, DC., S. Eur.
nobilis, Pers., Siber.

Cousinia Hystrix, Meyer, Caucas.

Crepis aculeata, DC., Eur.
alpina, L., Eur.
biennis, L., Eur.
Candollei, Spr., Eur.
pulchra, L., Eur.
rubra, L., S. Eur.
tectorum, L. fil., Eur., Siberia.

Crinum capense, Herb., Cape.
— var. riparium, Herb.

Crocus äerius, Herb. Armenia.
 aureus, Sm., S. Eur.
 asturicus, Herb., Spain.
 bannaticus, Heuffel, Transylvania.
 biflorus, Mill., Tuscany, etc.
 — var. Pestalozzæ, Boiss.
 — var. Weldeni, Gay.
 Clusii, Gay, Portugal.
 corsicus, Maw, Corsica.
 etruscus, Parl., Tuscany.
 Imperati, Ten., Neapol. district.
 medius, Balbis, Riviera.
 reticulatus, Bbrst., Caucas, etc.
 Salzmanni, Gay., Tangiers.
 speciosus, Bbrst., Caucas., etc.
 suaveolens, Bert., C. Italy.
 Suterianus, Herb., As. Minor.
 Tommasinianus, Herb., Dalmat.
 vernus, All., C. Eur.
 — var. albiflorus, Gay.
 — var. obovatus.
 versicolor, Ker, Marit. Alps.
 zonatus, Gay, Cilicia.

Crucianella
 ægyptiaca, L., Egypt.
 gilanica, Trin., Persia.
 græca, Boiss., S. Eur.

Crupina vulgaris, Cass., Eur.

Cryptostemma calendulaceum, R.Br., Cape.
 — var. hypochondriacum, (R.Br.)

Cuphea lanceolata, Ait., Mexico. (C. silenoides, Nees.)
 viscosissima, Jacq., Amer.
 Zimapani, Roezl, Mexico. (C. silenoides, var. Zimapani, Hort.)

Cuscuta monogyna, Vahl., Eur., etc. (C. lupuliformis, Krock.)

Cyananthus lobatus, Wall., Himal.

Cynodon Dactylon, L., Cosmop.

Cynoglossum furcatum, Wall., Ind.
 micranthum, Desf., China.
 pictum, Ait., S. Eur.

Cynosurus cristatus, L., Eur.

Cyperus flavescens, L., Eur., etc.
 longus, L., S. Eur.

Cysticapnos africanus, Gærtn., Cape.

Dactylis glomerata, L., Eur., etc.

Dahlia coccinea, Cav., Mexico. (D. Cervantesii, Lag.)
 Merckii, Lehm., Mexico.
 — var. (D. glabrata, Lindl.)

Dalea lagopus, Willd., Mexico.

Datura ferox, L., Ind., China.
 lævis, L. fil., Africa.
 Stramonium, L., Eur.
 Tatula, L., Eur., etc.

Daucus Carota, L., Eur., etc.
 hispidus, Desf., Eur., N. Afr.

Delphinium Ajacis, Reichb., S. Eur.
 cheilanthum, Fisch., Siberia.
 — var. bifidum.
 — var. elongatum.
 Consolida, L., Eur.
 crassifolium, Schrad., Cauc.
 elatum, L., Eur., etc.
 — garden varieties.
 — var. intermedium.
 formosum, Boiss. et H., Armenia.
 grandiflorum, L., China, etc. (D. chinense, Fisch.)
 — var.
 Kashmirianum, Royle., Himal.
 nudicaule, Torr. et Gr., Calif.
 triste, Fisch., Siberia.
 vestitum, Wall., Himal.

Deschampsia cæspitosa, Beauv., Eur. (Aira cæspitosa, L.)
 — var. vivipara.
 flexuosa, Trin., Eur. (Aira flexuosa, L.)

Dianthus alpinus, L., Alps.
 arenarius, L., Eur.
 Balbisii, Ser., Eur.
 barbatus, L., Eur.
 cæsius, Sm., Eur.
 — var.
 cruentus, Griseb., S. Eur.
 Cyri, Fisch. et Mey., Caucas.
 deltoideus, L., Eur.
 fragrans, Bbrst., Caucas.
 petræus, W. et K., Hungary.
 plumarius, L., Eur.
 — var. albus.
 — var. serotinus.

Dianthus—*cont.*
prolifer, L., Eur., Siber.
Requienii, G. et G., S. Eur.
sanguineus, Vis., Alps, etc.
Scheuchzeri, Rchb., Eur.
Seguieri, Vill., Eur.
squarrosus, Bbrst. Tauria.
trifasciculatus, Kit., Eur. (D. heptaneurus, Grsb.)

Dictamnus albus, L., W. Eur., Jap. (D. Fraxinella, Pers.)
— var. purpureus.

Digitalis ambigua, Murr., (D. grandiflora, Lam., D. ochroleuca, Jacq.), Eur.
mariana, Boiss., Spain.
purpurea, L., Eur.
— var. alba, Hort.
tomentosa, Link., Eur.

Dioscorea japonica, Thunb., Japan.

Diplotaxis erucoides, DC., Mediter.

Dipsacus asper, Wall., Himal.

Dischisma arenarium, C. A. Mey., Cape.

Dodecatheon Meadia, L., N. Amer.
— var. splendidum.

Doronicum caucasicum, Bbrst., Cauc., etc.
Pardalianches, L., Eur.
— var. glabrum, Hort.
— var. grandiflorum.
— var. minor.
plantagineum, L., Eur.
— var. excelsum., N.E., Brown. (D. "Harpur Crewe," Hort.)

Downingia elegans, Torr., Calif.

Draba aizoides, L., Eur.
altaica, Bunge., Asia.
Ardoinii, Hort.
aurea, Vahl, Greenland.
borealis, DC., Isl. of St. Paul.
bruniæfolia, Stev., Caucas.
carinthiaca, Hopp., Eur.
chamæjasme, Griseb., Eur.
fladnicensis, Wulf., Carniol.
— var. corymbosa, Wats. (D. corymbosa, R.Br.)
frigida, Saut., Alps, Eur.
hirta, L., N. Eur.
hispanica, Boiss., Spain.
incana, L., Eur.

Draba—*cont.*
— var. contorta.
Kotschyi, Stur., Eur.
lactea, Adams, Siberia.
lapponica, Willd., Eur.
lasiocarpa, Reichb., S. Eur.
laxa, Lindlb., Eur.
nivalis, Lilj., Norway, etc.
subamplexicaulis, C. A. Mey., Siberia.
Thomasii, Koch, Tyrol.
tridentata, DC., Caucasus.
verna, L., Eur., N. Amer.

Dracocephalum Moldavica, L., Siber., etc.
nutans, L., Siberia.
parviflorum, Nutt., N. Amer.
peregrinum, L., Siberia.
Ruyschiana, L., Eur., Asia.
stramineum, Kar. et Kir., Russia.

Dryas octopetala, L., Eur., Amer.
— var. Drummondii, Wats.

Drymaria cordata, Willd., S. Amer.

Echinops ruthenicus, Reichb., S. Eur.
— var.
sphærocephalus, L., Eur.
— var. giganteus.
xanthocanthus, Hort.

Echium pustulatum, S. et S., S. Eur.

Elsholtzia cristata, Willd., S. Eur.

Elymus canadensis, L., N. Amer.
— var. glaucifolius, Gray.
virginicus, L., N. Amer.

Emilia sagittata, DC., India. (Cacalia coccinea, Sims.)

Encelia subaristata, Gray., N. Amer.

Epilobium angustifolium, L., Eur.
— var. album.
— var. major.
Billardierianum, Sering., N. Zeal.
hirsutum, L., Eur.
Lamyi, Schultz, S. Eur.
mexicanum, Moc., Mexico.
nummulariæfolium, A. Cunn., N. Zeal.
— var. longipes.
rosmarinifolium, Hænke, Eur.

Epilobium—*cont.*
— var. Fleischeri, (Hochst.)
— var. sericeum.
roseum, Schreb., Eur., etc.

Epipactis palustris, Crantz, Eur.

Eranthis hyemalis, Salisb., Eur.

Eremostachys laciniata, Bnge, W. Asia.

Eremurus altaicus, Stev., Caucas.
spectabilis, Bbrst., Caucas.

Erianthus strictus, Baldw., N. Amer.

Erigeron bellidifolius, Muhl., N. Amer.
glabellus, Nutt., N. Amer.
macranthus, Nutt., N. Amer.
mucronatus, DC., Mexico.
philadelphicus, L., N. Amer.
speciosus, DC., N. Amer. (Stenactis speciosa, Ldl.)
strigosus, Muhl., N. Amer.

Erinus alpinus, L., Eur.
— albus.

Eriosynaphe tortuosa, Fisch. et Mey., Siber.

Eritrichium strictum, Dcne., Himal.

Erodium cicutarium, L'Herit., Eur.
malacoides, Willd., S. Eur., etc.
macradenium, L'Herit., Alps.

Ervum Lens, L., Eur., etc.

Eryngium Bourgati, Gouan, Pyren., etc.
giganteum, Bbrst., Caucas.
maritimum, L., Eur.
Olivieranum, Delar. Caucas.
planum, L., S. Eur., etc.
Serra, Chmss., Brasil.

Erysimum asperum, DC., N. Amer.
Marshallianum, Andrz., Siber.
Perowskianum, Fisch. et Mey., Caucas.
rupestre, DC., Asia Minor.

Erythræa Centaurium, Pers., Eur.
diffusa, Woods, Azores.
grandiflora, Biv., Eur.
pulchella, Fries, Eur.

Eschscholtzia californica, Cham., Calif.
— var. alba.

Eschscholtzia—*cont.*
— cæspitosa, Brewer. (E. tenuifolia, Bth.)

Eucharidium concinnum, F. et M., Calif.
— var. grandiflorum.

Eupatorium ageratoides, L., N. Amer. (E. Fraseri, Hort.)
cannabinum, L., Eur., Cauc.
purpureum, L., N. Amer.

Euphorbia heterophylla, L., Ind., etc.
Lagascæ, Spr., Spain.
medicaginea, Boiss., Spain.
Myrsinites, L., Eur.
Peplus, L., Eur.
terracina, L., Italy, etc.

Evax asterisciflora, Pers., Eur.

Fagopyrum tataricum, Gaertn., Ind.

Farsetia clypeata, R.Br., S. Eur.

Fedia Cornucopiæ, Vahl., S. Eur.

Felicia tenella, Nees, Cape.

Ferula communis, L., Eur.
Ferulago, L., S. Eur., N. Afr.
Narthex, Boiss., Asia.
tingitana, L., N. Afr.

Festuca arundinacea, Schreb., Eur. (F. decolorans, Mert.)
ciliata, Danth., S. Eur. (Vulpia ciliata, Link.)
duriuscula, L., Eur., Amer.
elatior, L., Eur., etc.
— var. pratensis, (Huds.)
elegans, Boiss., Spain.
Halleri, All., S. Eur.
heterophylla, Haenke, Eur.
Myurus, L., Eur. (Vulpia Myurus, Gmel.)
ovina, L., Eur.
rigida, Kunth, Eur. (Sclerochloa rigida, Panzer.)
rubra, L., Eur.
sciuroides, Roth, Eur. (Vulpia bromoides, Link, F. bromoides, L.)
scoparia, Kern., Pyren.

Filago germanica, L., Eur.

Flaveria Contrayerba, Pers., Chili, Peru.
repanda, Lag., N. Amer.

Forskohlea tenacissima, L., Egypt.

Francoa ramosa, Cav., Chili.
(F. picturata, Van Houtte.)

Fritillaria imperialis, L., Eur.
Meleagris, L., Eur.
pontica, Wahl., Bithynia.
tenella, Bbrst., Caucas.

Fumaria densiflora, DC., Eur.
— var. (micrantha, Lag.)
major, Bad., Eur. (F. media, DC.)
officinalis, L., Eur.
parviflora, Lam., Eur.
Vaillantii, Loisel., Eur.

Funkia lancifolia, Spr., Japan.
— var. albo-marginata, Hort.
ovata, Spr., Japan.
Sieboldiana, Lodd., Japan.
subcordata, Spr., Japan.
(F. grandiflora.)

Gaillardia pulchella, Foug., N. Amer.
— var. grandiflora, Hort.
aristata, Pursh, N. Amer.
(G. Richardsoni, Hort.)

Galatella (*see* Aster).

Galega orientalis, Lam., Orient.
— var.

Galeopsis pyrenaica, Bartl., Pyren.

Galinsoga parviflora, Cav., Amer.

Galium agreste, Wallr., Eur.
boreale, L., Eur.
Cruciata, Scop., Eur.
Lapeyrousianum, Jord., Pyren.
Mollugo, L., Eur.
parisiense, L., Eur.
— var. leiocarpum.
recurvum, Reg., Greece.
rubrum, Scop., S. Eur.
saccharatum, All., Eur.
tenuissimum, Bbrst., Cauc.
tricorne, With., Eur.
uliginosum, L., Eur.

Gentiana asclepiadea, L., S. Eur.
— var. alba.
cruciata, L., Eur. Siber.
lutea, L., Eur.
sceptrum, Griseb, N. Amer.
septemfida, Pall., Caucas.
(G. gelida, Hort.)

Gentiana—*cont.*
tibetica, King, Himal.
(G. macrophylla, Hort.)
verna, L., Eur.

Geranium armenum, Boiss., Orient.
carolinianum, L., N. Amer.
Endressi, Gay, Pyrenees.
eriostemon, Fisch., Dahuria.
gracile, Schrad., Siberia.
Grevilleanum, Wall., Himal.
(G. Lamberti, Sweet.)
gymnocaulon, DC., Caucas.
Londesii, Fisch., Siber., etc.
— var.
lucidum, L., Eur.
macrorhizon, L., Eur.
maculatum, L., N. Amer.
molle, L., Eur.
Richardsonii, F. et M., N. Amer.
rotundifolium, L., Eur.
sanguineum, L., Eur.
striatum, L., Italy.
sylvaticum, L., Eur.
Vlassovianum, DC., Dahur., etc.
Wallichianum, Sweet, Himal.
— var.

Geum capense, Thunb., Cape.
hispidum, Fr., Spain.
macrophyllum, Willd., Siber.
montanum, L., Alps, Eur.
pyrenaicum, Ram., Pyrenees.
rivale, L., Eur.
triflorum, Pursh, N. Amer.
(Sieversia triflora, Spr.)
tyrolense, Host, Tyrol.
urbanum, L., Eur., etc.

Gilia achilleæfolia, Bth., Calif.
androsacea, Steud., Calif.
(Leptosiphon androsaceus Bth.)
capitata, Dougl., Calif.
inconspicua, Dougl., Calif.
laciniata, R. et P., Chili, Peru.
micrantha, Steud., Calif.
(L. luteus, Benth.)
Navarettia, Steud., Chili.
tricolor, Benth., Calif.

Glaucium corniculatum, Curt., S. Eur.
— var. rubrum, Hort.
flavum, Crantz., Eur. (G. luteum, Scop.).

Globularia trichosantha, Fisch. et Mey., Orient.

Glossocomia (*see* Codonopsis).

Glyceria elongata, Trin., N. Amer.
maritima, Wahl., Eur.
remota, Fr. Eur.
(G. norvegica, Smf.)

Gnaphalium indicum, L., India.

Godetia (*see* Œnothera).

Gypsophila Gmelini, Bunge., Russia.
paniculata, L., Siberia.
Rokejeka, Del., Egypt.

Hablitzia tamnoides, Bbrst., Caucas.

Harpæcarpus (*see* Madia).

Hebenstreitia dentata, Thunb., Cape.
— var. integrifolia, L.
tenuifolia, Schrad., Cape.

Hedypnois (*see* Rhagadiolus).

Hedysarum denticulatum, Regel.
microcalyx, Baker, Himal.
neglectum, Ledb., Altai.
obscurum, L., Eur.

Helenium autumnale, L., N. Amer.
— var. pumilum, Gray.
— var. 2.
Hoopesii, Gray, N. Amer.

Helianthemum ægyptiacum, Mill., Egypt, etc.
formosum, Dunal, Eur.
marifolium, Mill., Eur.
(Rhodax, Steud.)
polifolium, Mill., Eur.
salicifolium, Pers., Eur.
vulgare, Gærtn., Eur.
— var.
— var. roseum, DC.
— var. rhodanthum, (Dunal.)
— var. tomentosum, (Dunal.)

Helianthus annuus, L., N. Amer.
argophyllus, Torr, et Gray., Amer.
decapetalus, L., N. Amer.
— var. ? multiflorus, Gray.
mollis, Lam., N. Amer.
rigidus, Desf., N. Amer.

Helichrysum bracteatum, Willd., Austral.
— var. album.

Helichrysum—*cont.*
— var. luteum.
Buhseanum, Boiss., Persia, etc.
orientale, DC., Orient.
rutidolepis, DC., Austral.

Heliophila amplexicaulis, L. fil., Cape.
araboides, Sims, Cape.
(H. pilosa, Lam.)
crithmifolia, Willd., Cape.

Heliopsis lævis, Pers., N. Amer.

Helipterum corymbiferum, Schl., N. Zeal.
Manglesii, Bth., Austral.
(Rhodanthe Manglesii, Ldl.)
Milleri, Hort., Australia.
roseum, Benth., Australia.
(Acroclinium roseum, Hk.)

Helleborus colchicus, Regel, Levant.
fœtidus, L., Eur., etc.
guttatus × colchicus, hybrid.
intermedius, Guss., Calabria.
orientalis, Lam., Greece.
— var. roseus.
purpurascens, W. et K., Hungary.

Hemerocallis Dumortieri, Morren. Japan (H. Sieboldii, Hort.)
flava, L., S. Eur.
minor, Mill, Siberia.

Hemilepis Ehrenbergii, Kunze, S. Europe.

Heracleum asperum, Bbrst., Caucas.
pubescens, Bbrst., Cauc., etc.
— var. gummiferum, (Willd.)
Sprengelianum, W.A., Ind. Or.
villosum, Fisch., Russia.

Hesperis matronalis, L., Eur., Siber.

Heuchera americana, L., N. Amer.
cylindrica, Dougl., N. Amer.
hispida, Pursh, N. Amer.
(H. Richardsonii, R. Br.)
micrantha, Dougl., N. Amer.
pubescens, Pursh, N. Amer.

Hibiscus Trionum, L., Cosmopol.
(H. africanum, Hort.)

Hieracium amplexicaule, L., Eur.
aurantiacum, L., Eur.

Hieracium—*cont.*
compositum, Lap., Pyrenees.
flexuosum, W. et K., Eur.
lapsanoides, Lap., Pyrenees.
longifolium, Schleich., Switzerl.
maculatum, Sm., Eur.
— var. Moëanum, Lindeb., Norway.
pallidum, Biv., Eur.
Pilosella, L., Eur.
pratense, Tausch., Eur.
prenanthoides, Vill., Eur.
— var. riphæum, Uechtr.
saxatile, Jacq., S. Eur.
stoloniflorum, W. et K., S. Eur.
villosum, L., Eur.
vulgatum, Fries, Eur.

Hierochloe borealis, Roem. et Schult., Eur.

Holcus lanatus, L., Eur.

Homogyne alpina, Cass., Eur.

Hordeum jubatum, L., N. Amer.

Horminium pyrenaicum, L., Pyren.

Hoteia (*see* Astilbe).

Hutchinsia gracilis, Hort.

Hyacinthus amethystinus, L., Spain.
dubius, Guss., S. Eur.
romanus, L., S. Eur., etc. (Bellevalia romana, Reichb.)

Hydrocotyle ficarioides, Lam., Mauritius.

Hydrophyllum canadense, L., N. Amer.
virginicum, L., N. Amer.

Hyoscyamus niger, L., Eur.
— var. albus, Hort.
orientalis, Bbrst., Cauc.
pusillus, L., Persia.

Hypecoum grandiflorum, Benth., S. Eur.
procumbens, L., S. Eur.

Hypericum elatum, Ait., N. Amer.
elodeoides, Choiss., Nepal.
patulum, Thunb., Japan.
perforatum, L., Eur., China.
quadrangulum, L., Eur.
Richeri, Vill., Eur.
— var. Burseri, Spr.

Hypochæris ætnensis, Ces. et Pass., Medit.
(Metabasis ætnensis, DC.)
arachnoidea, Poir., N. Afr.

Iberis amara, L., Eur.
Garrexiana, All., Pyrenees.
Lagascana, DC., Spain.
saxatilis, L., Eur.
sempervirens, L., Eur.
umbellata, L., S. Eur.
— var. carnea.

Impatiens parviflora, DC., Siberia, etc.
Roylei, Walp., Himal.
— var.
tricornis, Wall., Ind.

Inula Bubonium, Jacq., Eur., etc.
ensifolia, L., Eur., etc.
grandiflora, Willd., Caucas., etc.
glandulosa, Willd., Caucas.
graveolens, Desf., Eur.
hirta, L., Eur.
Hookeri, Clarke, Himal.
montana, L., Eur.
salicina, L., Eur.
Vaillantii, Vill., Eur.

Iris Fieberi, Seidl., Eur.
Guldenstædtiana, Lepech., Siber.
neglecta, Horn., Eur., *vars.*
ochroleuca, L., Siber. (I. gigantea, Carrière.)
Pseudacorus, L., Eur., etc.
— var. acoriformis, (Bor.)
— var. Bastardi, (Bor.)
setosa, Pallas, Siberia.
— var. atropurpurea.
sibirica, L., Eur., Siberia.
— var. acuta, (Willd.)
— var. alba, Hort.
spuria, L., Cent. Eur., etc.
— var. desertorum, (Ker.)
— var. notha, (Bbrst.)
squalens, L., Eur.
Statellæ, Todaro, Eur.
Tolmieana, Herb., N. Amer.
versicolor, L., N. Amer.
virginica, L., N. Amer.

Isatis tinctoria, L., Eur., etc.

Isopyrum fumarioides, L., S. Eur.

Iva xanthiifolia, Nutt., N. Amer. (Cyclachæna xanthiifolia, Fres.)

Jasione montana, L., Eur.
perennis, L., Eur.

Juncus balticus, Willd., Eur.
Chamissonis, Benth., S. Amer.
compressus, Jacq., Eur.
glaucus, Ehrh., Eur.
platycaulis, H. B.K.S., Amer.
supinus, Mœnch., Eur.
trifidus, L., Eur.

Knautia (*see* Scabiosa).

Kœleria cristata, Pers., Eur.

Kœlpinia (*see* Rhagadiolus).

Lactuca angustana, All., S. Eur.
cracoviensis, Bueck, Eur.
flavida, Jord., France.
lactucaria, Jacq., Eur.
muralis, Fries, Europe.
Plumieri, Gren. et Godr., S. Eur.
sativa, L., Eur., Cult.
Scariola, L., Eur.
undulata, Ledeb., Siberia.
virosa, L., Eur.

Lagurus ovatus, L., Eur.

Lallemantia iberica, F. et M., Orient.
peltata, Fisch. et Mey., Caucas.
Royleana, Bth., Turkest., etc.

Lamium garganicum, L., S. Eur.
maculatum, L., Eur.

Lapsana communis, L., Eur.

Lathraea Squamaria, L., Eur.

Lathyrus angulatus, L., S. Eur.
Aphaca, L., Eur.
articulatus, L., S. Eur.
aureus, Benth. et Hook., Taur.
(Orobus aureus, Stev.)
Clymenum, L., S. Eur.
(O. Jordani, Tenore.)
cyanea (Stev.) Caucas.
(O. cyaneus, Stev.)
filiformis, Lam., S. Eur.
lathyroides, B. et H., Siber.
(O. lathyroides, L.)
luteus, B. et H., Asia Minor.
(O. luteus, L.)
macrorrhizus, Wimm., Eur.
niger, Wimm., Eur.
(O. niger, L.)
Ochrus, L., Eur.

Lathyrus—*cont.*
pisiformis, L., Siberia, etc.
rotundifolius, Willd., Caucas.
sativus, L., Eur.
— var. albus.
sphæricus, Retz., Eur.
sylvestris, L., Eur.
— var. platyphyllus, (Retz.) Nym.
tenuifolius, Desf., Eur., etc.
tingitanus, L., N. Afr.
— var. atropurpureus.
tuberosus, L., Eur.
variegatus, B. et H., Pyrenees.
(O. variegatus, Lap.)
varius, B. et H., S. Eur.
(O. varius, Sims.)
venosus, Muhl., N. Amer.
— var.
vernus, Bernh., Siber.
(O. vernus, L.)
— var. flaccidus (Kit.)

Lavatera thuringiaca, L., Eur., etc.

Layia calliglossa, Gray, Calif.
Douglasii, Hook. et Arn., Calif.
elegans, Torr et Gr., Calif.
heterotricha, Gray, Calif.
(Callichroa platyglossa, Fisch. et Mey.)

Leontopodium alpinum, Cass., Eur.

Leonurus Cardiaca, L., Eur.

Lepidium cordatum, Willd., Siber.
incisum, Roth, Eur.
Menziesii, DC., N. Amer.
sativum, L., Eur.

Leptosiphon (*see* Gilia).

Leptosyne (*see* Coreopsis).

Leucoium æstivum, L., Eur., etc.

Levisticum officinale, Koch., Eur.

Liatris spicata, Willd., N. Amer.

Libanotis montana, Crantz, Eur.
sibirica, Koch., Eur., etc.

Ligularia (*see* Senecio).

Ligusticum alatum, Spr., Caucas.
pyrenaicum, Gouan, Pyren.

Lilium Batemannæ, Hort.
giganteum, Wall., Nepal.
tigrinum, Gawl., China, Japan.

Linaria amethystea, Hoffmg. et Link., Spain.
anticaria, Boiss., Spain.
bipartita, Willd., N. Afr.
— var. versicolor, Hort., Kew.
Broussonetii, Poir., Orient.
capraria, M. et D., Italy.
chalepensis, Mill., S. Eur.
Cymbalaria, Mill., Eur.
maroccana, Hk. fil., Marocco.
minor, Desf., Eur., N. Afr.
origanifolia, Ait., Eur.
purpurea, L., Eur., etc.
repens, Mill., Eur.
saxatilis, DC., S. Eur.
spartea, Hoffm., S. Eur.
triphylla, Willd., S. Eur.
tristis, Mill., S. Eur.

Lindelofia spectabilis, Lehm., Himal.

Linum alpinum, L., Eur. (L. Leonii, Schultz.)
flavum, L., Eur.
(L. campanulatum, Hort.)
grandiflorum, Desf., Algiers.
perenne, L., Eur., etc.
— Lewisii, (Mhlbrg.)

Lithospermum prostratum, Loisel., Eur.

Loasa hispida, L., Peru.
prostrata, Gill., Chili.
volcanica, Andr., New Gren.
(L. Wallisii, Hort.)

Lobelia Cliffortiana, L., N. Amer.
decumbens, Rich.,
ramosa, Bth., N. Zeal.

Lœflingia hispanica, L., Eur.

Lolium perenne, L., Eur.
— var. italicum, (Braun.)
temulentum, L., Eur.

Lonas inodora Gærtn., Sicily.
(Athanasia annua, L.)

Lopezia coronata, Andr., Mexico.
(L. minuta, Hort.)

Lophanthus anisatus, Bth., N. Amer.
chinensis, Benth., China, etc.

Lotus corniculatus, L., Eur.
edulis, L., Eur.
ornithopodioides, L., Eur.
tenuis, W. et K., Eur., etc.

Lunaria annua, L., Eur.
rediviva, L., S. Eur.

Lupinus angustifolius, L., S. Eur.
arboreus, Sims, N. Amer.
— var.
Cosentini, Guss., Greece, etc.
elegans, H. B. K., Mexico.
luteus, L., France, etc.
micranthus, Dougl., N. Amer.
nootkatensis, Don, N. Amer.
polyphyllus, Ldl., N. Amer.
— var.
— var. densus.
subcarnosus, Hook., Amer.
varius, L., Eur.

Luzula campestris, DC., Eur.
nivea, Desv., Alps, etc.

Lychnis alba, Mill., Eur.
(L. vespertina, Sibth.)
alpina, L., Eur.
chalcedonica, L., E. Eur., etc.
— var. alba.
Coronaria, Desv., S. Eur.
corsica, Loisel., Eur.
diurna, Sibth., Eur.
diurna × alba, Hort.
Flos-jovis, Desv., S. Eur.
Githago, Lam., Eur. (Agrostemma Githago, L.)
Haageana, Lemaire, Japan.
— var. hybrida.
læta, Ait., S. Eur., etc.
oculata, Ldl., Levant.
— var. elegans.
pyrenaica, Berger., Pyren.
Viscaria, L., Eur.
— var. alba.

Lycopersicum racemigerum, Lange, S. Amer.

Lycopus exaltatus, L. fil., Eur., etc.
europæus, L., Eur.

Lysimachia ciliata, L., N. Amer.
Ephemerum, L., France, etc.
vulgaris, L., Eur.

Lythrum Salicaria, L., Eur.
— var. roseum.
— var. tomentosum, (Mill.)
virgatum, L., Eur.

Madia filipes, Gray, S. Calif., etc.
(Harpæcarpus madarioides, Nutt.)
sativa, Molina., Oregon, Calif.
— var.
— var. congesta, T. et Gr.
— var. racemosa, Gray. (M. mellosa, Jacq.)

Malcolmia africana, R.Br., S. Eur., N. Afr.
Chia, DC., Greece.
maritima, R.Br., S. Eur., etc.
Malope trifida, Cav., N. Afr.
— var. alba.
Malva Alcea, L., Eur.
— var. Morenii, (Poll.)
cretica, Cav., S. Eur.
crispa, L.
Duriæi, Spach., Eur.
parviflora, L., Eur.
rotundifolia, L., Eur.
sylvestris, L., Eur., etc.
verticillata, L., Eur.
(M. glomerata, Hort.)
Malvastrum limense (L.) Chili.
Marrubium astracanicum, Jacq., Caucas.
Marshallia cæspitosa, Nutt., Texas, etc.
— var. foliosa.
Matricaria callosa, Sch., Eur.
caucasica, Benth., Caucas.
(Pyrethrum caucasicum, Willd.)
Chamomilla, L., Eur.
— var. Courrantiana, DC.
glabra, Nym., S. Eur.
(M. arvensis, Nym.)
inodora, L., Eur.
Matthiola bicornis, DC., Greece.
incana, R.Br., Medit.
tricuspidata, R.Br., Medit.
Meconopsis cambrica, Vig., Eur.
Wallichiana, Hook, Himal.
Medicago apiculata, W., Eur.
(Berteroana, Mor.)
Aschersoniana, Urban, N. Afr.
ciliaris, Willd., Eur.
(M. intexta, Willd.)
denticulata, Willd., Eur.
disciformis, DC., Spain.
Echinus, DC., S. Eur.
Hornemanniana, Pers., Eur.
lappacea, Desr., S. Eur.
lupulina, L., Eur.
orbicularis, Willd., S. Eur.
rugosa, Desr., Eur.
rigidula, Lam., S. Eur.
(M. Gerardi, Kit.)
Terebellum, Willd., S. Eur.
tornata, Willd., Eur.
tribuloides, Lam., S. France.
— var. truncatula, Gaert.
Melica altissima, L., S. Eur., Cauc., etc.
ciliata, L., Eur., etc.
— var. Cupani, (Guss.)
— var. Magnolii, (G. et G.)
nutans, L., Eur.
uniflora, Retz., Eur.
Melilotus alba, Desr., Eur.
officinalis, Desr., Eur.
parviflora, Lam., Eur.
(M. indica, All.)
Mentha piperita, Huds., Eur.
Requienii, Bth., Corsica.
rotundifolia, L., Eur.
sylvestris, L., Eur.
— var. umbrosa, Opiz.
viridis, L., Eur.
— var. crispa, Hook.
Mertensia sibirica, Don., Siber.
Mesembryanthemum pinnatifidum, L. fil., Cape.
tricolor, Willd., Cape.
— var. album.
Micromeria nervosa, Bth., var. Rodriguesii, Janka, Balear.
Microseris linearifolia, Gray, N. Amer. (Calais linearifolia, DC.)
Lindleyi, Gray., Calif.
(C. Lindleyi, DC.)
pygmaea, DC., Chili.
Mimulus cardinalis, Dougl., N. Amer.
luteus, L., N. Amer.
ringens, L., N. Amer.
Mirabilis multiflora, Gray, Amer.
Mitella Breweri, Gray, N. Amer.
diphylla, L., N. Amer.
pentandra, Hook., N. Amer.
Modiola multifida, Mœnch, N. Amer.
(M. caroliniana, Hort.)
Molinia cærulea, Mœnch, Eur.
— var. variegata.
Molopospermum cicutarium, DC., C. et S., Eur.
Monarda didyma, L., N. Amer.
Moricandia arvensis, DC., Eur., etc.
Morina longifolia, Wall., Nepal.
Muhlenbergia diffusa, Schreb., N. Amer.
pendula, Trin., Ins. Sitcha.
Willdenovii, Trin., N. Amer.
Mulgedium (*see* Lactuca).

Muscari armeniacum, Baker, Medit.
Heldreichii, Boiss., Greece.
neglectum, Guss., S. Eur.
racemosum, Mill., Eur.
Szovitsianum, Regel, Siber.
Myosotis arvensis, Hoffm., Eur.
sylvatica, Hoffm., Eur.
Myosurus minimus, L., Eur., etc.
Myrrhis odorata, Scop., Eur.
Nemesia floribunda, Lehm., Cape.
pubescens, Benth., Cape.
versicolor, Meyer, Cape.
Nemophila insignis, Dougl., Calif.
— var. alba, Hort.
maculata, Bth., Calif.
Menziesii, Hook. et Arn., Calif. (N. discoidalis, Flore des Serres.)
parviflora, Dougl., N. Amer.
phacelioides, Nutt., N. Amer.
Neogaya mucronata, Regel., Siberia.
Nepeta discolor, Royle., India.
Neslia paniculata, Desv., Eur.
Nicotiana acuminata, Graham, Peru.
acutifolia, St. Hil., Brazil.
affinis, T. Moore.
alata, Link., Brazil.
chinensis, Fisch., China.
fragrans, Bernh.
paniculata, L., S. Amer.
plumbaginifolia, Viv., N. Amer.
repanda, Willd., N. Amer.
rustica, L., S. Eur., etc.
— var. Lebanon.
— var. Syrian.
— var. (Texana Hort.)
— var. “Bhilsa.”
Tabacum, L., S. Amer.
— var. attenuata, Hort.
— var. “Latakia.”
— var. “Manila.”
— var. “Maryland.”
— var. “Virginian.”
viridiflora, Lag.
Nigella damascena, L., S. Eur.
integrifolia, Regel, Afghanistan.
orientalis, L., Caucas., etc.
sativa, L., S. Eur.
Nolana atriplicifolia, D. Don, Peru.
Nonnea rosea, Bbrst., Caucas. (N. versicolor, (Sweet ?)
ventricosa, Griseb.
Nothoscordum fragrans, Kunth., Amer.
Ocimum campechianum Mill., Cent. Amer.
Petitianum, Rich., Abyss.
Œnanthe gymnorrhiza, Brign., C. et S., Eur.
karsthia, Hacq., Carniol.
peucedanifolia, Poll., Eur.
Œnothera amœna, Lehm., Calif. (Godetia amœna, Lilja.)
biennis, L., N. Amer.
bistorta, Nutt., N. Amer.
fruticosa, L., N. Amer.
Lamarckiana, Ser., N. Amer. (Œ. biennis var. grandiflora, T. et G.)
lepida, Steud., Calif.
pumila, L., N. Amer.
purpurea, Curt., N. Amer. (Godetia purpurea, Wats.)
quadrivulnera, Dougl., N. Amer. (G. quadrivulnera, Spach.)
rosea, Ait., N. Amer.
tenella, Cav., Chili, Amer. (G. tenella, Wats.)
— var. dasycarpa.
torquensis, H. B. K., Quito.
triloba, Nutt., N. Amer.
— var. rhizocarpa, Spr.
Omphalodes linifolia, Mœnch, S. Eur.
Ononis spinosa, L., Eur., etc.
Onopordon virens, DC., S. Eur., etc.
Opuntia Rafinesquii, Eng., N. Amer.
Orchis maculata, L., Eur.
Orlaya (*see* Caucalis).
Ormenis (*see* Anthemis).
Ornithogalum exscapum, Ten., S. Eur.
fimbriatum, Willd., Orient.
latifolium, L., Egypt, etc.
orthophyllum, Ten., S. Eur.
tenuifolium, Guss., Sicily.
umbellatum, L., Eur., N. Afr.
unifolium, Ker, S. Eur.
Ornithopus perpusillus, L., Eur.
Orobanche minor, Sm., Eur.
ramosa, L., Eur.
rubra, Sm., Eur.

Orobus (*see* Lathyrus).
Oxybaphus nyctagineus, Sw., N. Amer.
Oxyria digyna, Hill., Eur.
elatior, R. Br., Nepal.
Oxytropis campestris, DC., Eur.
ochroleuca, Bunge, Siber.

Pæonia albiflora, Pall., China.
— var. candida, And.
arietina, And., Orient.
— var. Andersoni.
— var. byzantina, Hort.
decora, And., Orient.
— var. Pallasii, Hort.
officinalis, Retz., Eur.
— var. anemonæflora, Hort.
tenuifolia, L., Siber.
triternata, Pall., Taur., etc. (daurica, And.)
Palimbia salsa, Bess., Russia.
Panicum Crus-galli, L., S. Eur.
maximum, Jacq., S. Amer.
Papaver apulum, Ten., Italy, etc.
Argemone, L., Eur.
caucasicum, Bbrst., Caucas.
dubium, L., Eur.
floribundum, Desf., Armenia.
nudicaule, L., Alps.
orientale, L., Orient.
— var. bracteatum, (Lindl.)
— var. majus.
pavoninum, C. A. Mey., Afghan.
pilosum, Sibth., Greece.
— var.
— Heldreichii, (Boiss.)
Rhœas, L., Eur.
— var. Hookeri, (Baker).
rupifragum, Boiss., Spain.
— var. atlanticum, Ball, G. Atlas.
somniferum, L., China, etc.
— var. album.
— var. "Danebrog."
— var. fl. pl.
— var. setigerum, (DC.)
umbrosum, Hort.
Parietaria lusitanica, L., Eur.
Paronychia herniarioides, Nutt., N. Amer.
Pastinaca (*see* Peucedanum).
Pentstemon acuminatus, Dougl., N. Amer.
barbatus, Nutt., N. Amer.
— var. Torreyi, Gray.

Pentstemon—*cont.*
campanulatus, Willd., Mexico.
— var. roseus, Hort.
confertus, Dougl., N. Amer.
lævigatus, Soland., N. Amer.
— var. Digitalis, Gray. (P. Digitalis, Nutt.)
ovatus, Dougl., N. Amer.
pubescens, Soland., N. Amer.
Perezia multiflora, Less., Peru, etc.
Petrocallis pyrenaica, R.Br., Eur.
Petroselinum sativum, Hoffm., Eur.
— var. cordatum.
Petunia nyctaginiflora, Juss., La Plata.
Peucedanum Ostruthium, Koch., Eur.
(Imperatoria Ostruthium, L.)
sativum, Benth., Eur.
(Pastinaca sativa, L.)
Phacelia congesta, Hook., Calif.
divaricata, Gray., Calif.
Parryi, Torr., Califor.
tanacetifolia, Bth., Calif.
Whitlavia, Gray, Calif.
(Whitlavia grandiflora, Hort.)
— var. alba, Hort.
Phænosperma globosa, Munro, China.
Phalaris arundinacea, L., Eur., etc. (Digraphis arundinacea, Trin.)
— var. fol. variegatis.
canariensis, L., S. Eur., etc.
cærulescens, Desf., S. Eur., etc.
paradoxa, L., S. Eur.
tuberosa, L., Eur.
Phaseolus lathyroides, L., Jamaica.
multiflorus, Lam.
— var.
Ricciardianus, Ten.
vulgaris, L., India.
— var. alba.
Willmotianus, Mart.
Wightianus, Grah., India.
Phleum pratense, L., Eur.
— var. nodosum, (L.)
— var. parnassicum, Boiss.
tenue, Schrad., Eur.
Phlomis agraria, Ledeb., Siberia.
Russeliana, Lagas., Orient.
tuberosa, L., Caucas., Siber.
umbrosa, Turcz., Siberia.

Phlox amœna, Sims., N. Amer.
glaberrima, L., N. Amer.
paniculata, L., N. Amer.

Phuopsis stylosa, Benth. & Hook., Persia. (Crucianella stylosa, Trin.)

Physalis peruviana, L., Peru. (P. edulis, Sims.)

Physostegia virginiana, Bth., N. Amer.
— var. alba, Hort.

Phyteuma campanuloides, Bbrst., Cauc.
Halleri, All., S. Eur.
limonifolium, Sibth. & Sm., Eur.
nigrum, Schmidt, Germ.
orbiculare, L., Eur.
spicatum, L., Eur.

Pimpinella magna, L., Eur.
peregrina, L., S. Eur., etc.

Pisum Jomardi, Schrank, Egypt.
sativum, L., Eur.
— var. quadratum, Mill.
— var. thebaicum (Willd.)

Plantago arenaria, L., Eur.
Coronopus, L., Eur.
— var. Cupani, Guss.
Cynops, L., S. Eur.
fuscescens, Jord., S. Eur.
Ispaghula, Roxb., India.
lagopus, L., Eur. (P. eriostachya, Ten.)
maritima, L., Eur.
patagonica, Jacq., var. gnaphalioides, Gray., N. Amer. (P. gnaphalioides, Nutt.)

Platycodon grandiflorum, A.DC., Siber.
— var. Mariesii, Hort.

Pleurospermum pulchrum, Aitch. et Hemsl., Afghan.

Plumbago micrantha, Ledb., Siber.

Poa alpina, L., Eur.
— var. badensis, (Haenke).
compressa, L., Eur.
glauca, Sm., Eur.
nemoralis, L., Eur.
pratensis, L., Eur.
sudetica, Haenke, Eur.
trivialis, L., Eur.

Pocockia cretica, Ser., Eur.

Podophyllum Emodi, Wall., Himal.

Polemonium cæruleum, L., Eur., Amer., etc.
— var. album, Hort.
— var. bipinnatum, Hort.
— var. grandiflorum, Hort.
himalayanum, Baker, Himal.
humile, Willd., N. Amer.
reptans, L., N. Amer.

Polycnemum arvense, L., Eur.

Polygonatum biflorum, Ell., N. Amer. (P. pubescens, Pursh.)
giganteum, Dietr., N. Amer. (P. latifolium, Desf.)
japonicum, Morr. et Dcne., Japan.
multiflorum, All., N. T. Zone.
— var. fl. pl.
verticillatum, All., Eur.

Polygonum affine, Don, Himal. (P. Brunonis, Wall.)
amplexicaule, Don, Himal.
— var. oxyphyllum, (Wall.)
angustifolium, Poir, Siberia.
aviculare, L., Eur. (P. erectum, Rth.)
Bistorta, L., Eur.
divaricatum, L., Siber.
molle, Don, Himal.
orientale, L., Orient.
polymorphum, Led., Eur., Siber.
— var. songaricum, (Schrenk.)
viviparum, L., Eur.
Weyrichii, F. Schm., Sachal. Isl.

Polypogon littoralis, Sm., Eur.

Portulaca oleracea, L., China, etc.
— var. grandiflora, vars.
rostellata, Brign., Brazil.

Potentilla alchemilloides, Lap., Pyrenees.
ambigua, Jacq., Himal.
argyrophylla, Wall., Himal.
— var.
— var. Thomasii, (DC.)
bifurca, L., Caucas, etc.
collina, Wibel, Central Eur.
Comarum, Nestl., Eur.
flagellaris, Willd., Siber.
grandiflora, L. Alps.
montenegrina, Panc., Alps. (Buccoana, Clem. ?)
multifida, L., Eur., etc.

Potentilla—*cont.*
nepalensis, Hook., Nepal.
(P. formosa, Don.)
nevadensis, Boiss., Spain.
norvegica, L., Eur.
ontopoda, Dougl., N. Amer.
opaca, L., Eur., etc.
pedata, Willd., France.
pennsylvanica, L., N. Amer.
— var. arachnoidea, Lehm.
(P. arachnoidea, Dougl.)
pyrenaica, Ram., Pyrenees.
recta, L., Eur., Caucas.
— var. Hookeriana, (Lehm.)
— var. laciniata.
— var. macrantha, (Leab.)
— var. Nuttallii.
— var. obscura (Willd.)
— var. palmata.
— var. pentaphylla, (Rich.)
rupestris, L., Eur.
Sibbaldia, Haller fil., Himal.
(Sibbaldia procumbens, L.)
Thurberi, Gray., Calif.
Visianii, Panc., Eur.
Wrangeliana, Fisch., Siberia.

Poterium alpinum, Bunge, Siberia.
officinale, Benth. et Hook., Eur. (Sanguisorba officinalis, L.)
Sanguisorba, L., Eur.
sitchense, Wats., N. Amer.
(Sang. media, L.)

Prenanthes purpurea, L., Eur.

Primula cortusoides, L., Siber, etc.
denticulata, Sm., Ind.
elatior, Jacq., Eur.
involucrata, Wall., Himal.
japonica, Gray, Japan.
— var. alba.
mollis, Nutt., Bootan.
prolifera, Wall., Himal.
rosea, Royle, Ind.
sikkimensis, Hook., Himal.
veris, L., Eur.
verticillata, Forsk., Arabia.

Prunella grandiflora, L., Eur., Cauc.
— var. rubra, Hort.

Pteroneuron græcum, DC., Greece, etc.

Pterotheca nemausensis, Cass., S. Eur.

Pulmonaria angustifolia, L., Eur.
saccharata, Mill., Eur.

Pyrethrum. (*See* Chrysanthemum.)
Pyrrhopappus carolinianus, DC., Florida, Texas.
Ramondia pyrenaica, Rich., Pyrenees.
Ranunculus aconitifolius, L., Eur.
acris, L., Eur.
— var. Correanus.
— var. Steveni, Bess.
arvensis, L., Eur.
brutius, Tenore, Italy.
chærophyllus, L., Eur., etc.
Cymbalaria, Pursh, N. Amer.
falcatus, L., Eur. (Ceratocephalus falcatus, Pers.)
Flammula, L., Eur.
maritimus, Ph., Chili.
parviflorus, L., Eur.
Reuterianus, Boiss., S. Eur.
trachycarpus, F. et M., Orient.
Rapistrum Linnæanum, All., Eur.
Reseda abyssinica, Fres., Abyss.
alba, L., S. Eur.
lutea L., Eur.
Phyteuma, L., Eur.
Rhagadiolus creticus, All., S. Eur.
(Hedypnois cretica, Willd.)
Hedypnois, All., Mediter.
(H. polymorpha, DC.)
Kœlphinia, Lam., Siber.
(Kœlpinia linearis, Pall.)
stellatus, Gærtn., S. Eur.
Rheum Emodi, Wall., Himal.
officinale, Baill., Thibet.
palmatum, L., Ind., etc.
— var. tanghuticum.
Rhaponticum, L., Siber.
songaricum, Schrenk, Songaria.
spiciforme, Royle, India.
undulatum, L., Siberia, etc.
Rhodanthe. (*See* Helipterum.)
Rhynchopsidium sessiliflorum, DC., Cape.
Rodigia commutata, Spr., Crete.
Romulea Bulbocodium, Seb., S. Eur.
Rudbeckia californica, Gray, Calif.
maxima, Nutt., N. Amer.
purpurea, L., N. Amer.
Rumex abyssinicus, Jacq., Abyss.
alpinus, L., Eur.
Brownianus, Campd., Austral.
nebroides, Campd., S. Eur.
nepalensis, Spr., Himal.

Rumex—*cont.*
obtusifolius, L., Eur.
— var. sylvestris, (Wallr.)
Patientia, L., S. Eur.
salicifolius, Weinm., N. Amer.
sanguineus, L., Eur.
vesicarius, L., N. Afr.

Salsola Kali, L., Eur.

Salvia argentea, L., Mediter.
clandestina, L., Greece, etc.
Columbariæ, Benth., Calif.
glutinosa, L., Eur.
hians, Royle., India.
hispanica, L., S. Eur.
Horminum, L., S. Eur.
nilotica, Vahl, Egypt.
officinalis, L., S. Eur.
— var. alba, Hort.
Regeliana, Trautv., Siberia.
Sclarea, L., S. Eur.
sylvestris, L., S. Eur.
— var. alba, Hort.
tiliæfolia, Vahl, Mexico.
Verbenaca, L., Eur.
viscosa, Jacq., S. Eur.

Sanguisorba. (*See* Poterium.)

Sanvitalia procumbens, Lam., Mexico.

Saponaria orientalis, L., Orient.

Satureja hortensis, L., Taur., Caucas.
montana, L., S. Eur.

Saxifraga altissima, Kerner, Eur.
aphylla, Sternb., Eur.
— var. leptophylla.
aizoides, L., Eur., etc.
Aizoon, L., Eur., Alps.
— var. Churchillii, Kern.
— var. Gaudinii.
— var. incrustata.
— var. infracta.
— var. minor.
— var. pectinata, Schott.
— var. pygmæa.
— var. recta, (Lap.)
— var. rotata.
— var. rosularis, Schleich.
catalaunica, Boiss., Eur.
aretioides, Lap., Alps.
— var. primulina.
cæspitosa, L., Eur., etc.
— var. decipiens, (Ehrh.)
— var. hirta, (Don.)
— var. sedoides, (L.)

Saxifraga—*cont.*
Camposii, Boiss., Eur.
(S. Wallacei, Hort.)
Cotyledon, L., Eur., Alps.
— var. pyramidalis, (Lap.)
crustata, Vent., Alps.
cuneifolia, L., Alps.
— var. apennina, (Bert.)
— var. subintegra.
diversifolia, Wall., Himal.
exarata, Vill., Eur., Alps.
— var. nervosa, (Lap.)
geranioides, L., Eur.
Hostii, Tausch, Alps.
— var. Macnabiana, Hort.
— var. tristis.
integrifolia, Hook., N. Amer.
Kolenatiana, Regel, Siberia.
lactea, Turcz., Temp. Asia.
latepetiolata, Willk., Spain.
lingulata, Bell., Marit. Alps.
— var. cochlearis, (Rchb.)
— var. lantoscana, (Boiss.)
longifolia, Lap., Pyrenees.
Malyi, Schott, Eur.
Maweana, Baker, Marocco.
media, Gouan, Pyrenees.
muscoides, Wulf., Eur.
— var. purpurea.
— var. pygmæa, (Haw.)
mutata, L., Eur.
nivalis, L., Eur., etc.
peltata, Torr., N. Amer.
pedatifida, Ehrh., Eur.
pennsylvanica, L., N. Amer.
Prostii, Sternb., Eur.
Rocheliana, Sternb., Bosnia.
— var. coriophylla, (Griseb.)
sancta, Griseb., Maced.
sponhemica, Gmel., S. Eur.
Stracheyi, Hk., f. et Th., Himal.
tenella, Wulf., Alps.
tricuspidata, Rottb., Eur.
trifurcata, Schrad., N. Spain.
valdensis, DC., Savoy, Alps.

Scabiosa alpina, L., Alps.
arvensis, L., Eur. (Knautia arvensis, Coult.)
atropurpurea, L., Eur.
australis, Wulf., S. Eur.
(S. repens, Brign.)
caucasica, Bbrst., Cauc.
— var. amœna, (Jacq.)
Columbaria, L., Eur.
Fischeri, DC., Dahur.

Scabiosa—*cont.*
graminifolia, L., Eur.
Gramuntia, L., S. Eur.
maritima, L., S. Eur.
palæstina, L., Syria, etc. (Asterocephalus palæstinus, Spr.)
Portae, Huter., Eur.
stellata, L., Spain, Portugal.
Succisa, L., Eur.
Scandix Balansæ, Reut., Orient.
brachycarpa, Guss., Sicily.
Schistanthe peduncularis, Kunze, S. Afr.
Schizanthus pinnatus, R. et P., Chili.
var. albus, Hort.
Schizopetalum Walkeri, Sims, Chili.
Schœnus nigricans, L., Eur.
Scilla amœna, L., S. Eur., etc.
bifolia, L., Eur.
campanulata, Ait., Spain, etc. (S. hispanica, Mill.)
— var. alba, Hort.
italica, L., Italy, etc.
lingulata, Desf., N. Afr.
pratensis, W. et K., Croatia.
sibirica, Andr., Siberia.
verna, Huds., W. Eur.
Scirpus atrovirens, Muhl., N. Amer.
Caricis, Retz., Eur. (Blysmus compressus, Panz.)
triqueter, L., Eur.
rufus, Wahlb., Eur.
Scleranthus annuus, L., Eur.
perennis, L., Eur.
Scleropus amarantoides, Schrad., St. Thomas.
Scopolia lurida, Desf., Himal.
Scrophularia Ehrhartii, Stev., Caucas.
nodosa, L., Eur.
Scutellaria orientalis, L., Asia Minor.
peregrina, L., Tauria.
Secale Cereale, L., As. Minor.
montanum, Guss., Sicily.
Sedum Aizoon, L., Siberia.
anopetalum, DC., S. Eur.
crassipes, Wall., Sikkim, 15,000 feet.
Douglasii, Hook., N. Amer.
Ewersii, Ledeb., Siber.

Sedum—*cont.*
heterodontum, Hk. f., Himal.
hybridum, L., Siberia.
kamtschaticum, Fisch., Kamtsch.
Maximowiczii, Regel, Japan.
maximum, Reichb., C. Eur.
Middendorfianum, Max., Siber.
oppositifolium, Sims, Caucas.
— var.
populifolium, L., Siberia.
rupestre, Huds., Eur.
spurium, Bbrst., Caucas.
Selinum Candollei, DC., Nepal.
Sempervivum alpinum, G. et S., Alps.
arachnoideum, L., Alps. (Laggeri, Hort.)
arvernense, Lecoq et Lamotte, Eur.
atlanticum, Ball et Hook., Atlas.
barbatulum, Schott, Eur.
bicolor, Hort., Eur.
Boissieri, Hort., Eur.
Boutignyanum, Bill., Pyrenees.
Fauconnetii, Reut., Alps.
fimbriatum, L. et S., Eur.
flagelliforme, Fisch., Siber.
Funckii, Braun, Austria.
glaucum, Tenore, Italy. (S. violaceum, Hort.)
grandiflorum, Haw.
Hausmannii, Hort., Eur.
Lamottei, Boreau, France.
Mettenianum, Lehm., Switz.
montanum, L., Alps.
parvulum, J. et F., Eur.
Pomelii, Lamotte, Alps.
Schnittspahnii, Lag., Eur.
speciosum, Lamotte, Eur.
tectorum, L., Eur.
Verlotii, Lamotte, France. (S. Delassiæ, Hort.)
Senecio aureus, D., N. Amer.
concolor, DC., N. Afr.
Doronicum, L., Eur.
Doria, L., Eur.
elegans, L., Cape.
— var. alba.
— var. purpurea.
Fuchsii, Gmel., S. Eur.
macrophyllus, Bbrst., Caucas.

Senecio—*cont.*
quinquiculatus, Rgl., Asia Minor.
squalidus, L., Eur., etc.
thyrsoideus, DC., Siberia. (Ligularia thyrsoidea, DC.)
viscosus, L., Eur.

Serratula quinquefolia, Bbrst., Caucas.
tinctoria, L., Eur.
— var. indivisa, Poir.

Seseli gummiferum, Sm., Taur., etc.

Setaria glauca, Beauv., Eur.
italica, Beauv., Eur. (S. germanica, Beauv.)
macrochæta, Link, Eur., Asia, etc.

Sibbaldia. (*See* Potentilla.)

Sidalcea malvæflora, Gray, N. Amer. (S. oregana, Gray.)

Silaus tenuifolius, DC., Eur.

Silene alpestris, L., Alps, Eur.
ambigua, Camb., S. Eur.
Armeria, L., Eur.
— var. compacta (Hornem).
Chouleti, Coss., Eur.
ciliata, Pourr., Crete.
clandestina, Jacq., Cape.
colorata, Poir., Mediter.
conoidea, L., Levant, etc.
cretica, L., S. Eur.
diurniflora, Kunze, Cape.
echinata, Otth., Italy.
Fortunei, Vis., China.
fusca, Link, Portugal.
gallica, L., Eur.
— var.
Gerardi, Guss., Eur.
italica, Pers., Eur.
juvenalis, Del., Egypt.
linicola, Gmel., Germany.
longicilia, Otth, Portugal.
muscipula, L., Mediter.
pendula, L., Sicily, etc.
Persoonii, Tod. non Schott.
pseudo-atocion, Desf., N. Afr.
quadrifida, L., Eur.
rubella, L., Eur., N. Afr.
rupestris, L., Alps, Eur.
Saxifraga, L., Eur.
Schafta, Gmel., Siber., etc.
sericea, All., S. Eur.
tatarica, Pers., Tatar.
tenuifolia, Otth., Dahur.

Silene—*cont.*
trinervia, S. et S., S. Eur.
Vallesia, L., S. Eur.
vespertina, Retz., S. Eur.
Zawadskii, Herbich., Austria.

Silphium perfoliatum, L., N. Amer. (S. connatum, L.)
— var. conjunctum, (Willd.)

Silybum Marianum, Gærtner, Eur.

Sisymbrium Assoanum, R. et P., Aragon.
austriacum, Jacq., S. Eur.
myriophyllum, H. B. K., Quito.
officinale, Scop., S. Eur.
polyceratium, L., Eur.
strictissimum, L., Eur.

Sium angustifolium, L., Eur.
lancifolium, Bbrst., Cauc., etc.
latifolium, L., Eur.

Smilacina stellata, Desf., N. Amer.
racemosa, Desf., N. Amer. (Tovaria racemosa, Neck.)

Smyrnium Olusatrum, L., Eur.

Solanum guineense, Lam., Trop Afr., etc.
tuberosum, L., Chili.
— var. black tubers.
villosum, Lam., Eur.

Solidago elongata, Nutt., N. Amer.

Sonchus asper, Hoffm., Eur.
palustris, L., Eur.

Sorghum halepense, L., S. Eur., etc.

Specularia biflora, Fisch. et Mey., Russia.
coa, A.DC., Eur.
falcata, A.DC., Mediter.
— var. castellana, Lange.
pentagonia, A.DC., Orient.
perfoliata, DC., N. Amer.
Speculum, A.DC., Eur.

Spergula arvensis, L., Eur.

Sphenogyne. (*See* Ursinia.)

Spilanthes Acmella, L., India.
oleracea, L., Ind., S. Amer.

Spiræa astilboides, Hort.
Aruncus, L., N. Amer.
— var. angustifolius.
digitata, Willd., Siber., etc.
Filipendula, L., Eur.
lobata, Jacq., N. Amer.
— var. purpurea. (S. palmata var. purpurea, Hort.)

- Spiræa—*cont.*
  - palmata, Thunb., Japan.
  - — var. alba.
  - Ulmaria, L., Eur., etc.
  - — var. aurea.
- Stachys alpina, L., Caucus., etc.
  - arvensis, L., Eur.
  - grandiflora, Bth., Caucas., etc. (Betonica grandiflora, L.)
  - Betonica, Benth., Eur. (B. officinalis, L.)
  - — var. alba, Hort.
  - elliptica, H.B.K., S. Amer.
  - sylvatica, L., Eur.
- Statice auriculæfolia, Vahl, Eur.
  - — var. occidentalis, (Lloyd).
  - Gougetiana, Girard, Spain.
  - Limonium, L., Eur.
  - — var. Gmelini, (Willd.)
  - — var. puberula.
  - leptostachya, Boiss., Orient.
  - speciosa, L., Siberia.
  - Suworowii, Regel, Turkestan.
  - tomentella, Boiss., Eur., etc. (S. sareptana, Beck.)
- Stellaria graminea, L., Eur.
- Stevia laxiflora, DC., Mexico.
  - Plummeræ, Gray, S. Arizona.
  - — var. alba, Gray.
- Stipa Aristella, L., S. Eur., etc.
  - barbata, Desf., N. Afr.
  - Calamagrostis, Whlbrg., S. Eur. (Lasiagrostis Calamagrostis, Link.)
  - fertilis, Desf., S. Eur.
  - pennata, L., Eur., Siber.
- Succowia balearica, DC., Balearic Isles.
- Swertia perennis, L., Eur., etc.
- Symphytum asperrimum, Sims, Caucas.
  - bulbosum, Schimp., S. Eur.
  - — var. Zeyheri, (Schimp).
  - caucasicum, Bbrst., Caucas.
  - grandiflorum, DC., Orient. (ibericum, Stev.)
  - officinale, L., Eur.
- Tagetes pusilla, H.B., Quito.
  - Parryi, Gray, Mexico.
- Tamus communis, L., Eur.
- Telephium Imperati, L., S. Eur.
- Tellima grandiflora, R.Br., N. Amer.
- Tetragonia expansa, Murr., Austral., etc.
- Tetragonolobus biflorus, Sering., N. Afr.
  - conjugatus, Link., France.
  - purpureus, Mœnch, S. Eur.
- Teucrium aureum, Schreb., Eur.
  - Scorodonia, L., Eur.
  - — var. variegatum.
- Thalictrum angustifolium, Jacq., S. Eur.
  - aquilegifolium, L., Eur., etc.
  - — var. purpureum.
  - flavum, L., Eur.
  - — var.
  - — var. sphærocarpum, Lej.
  - glaucum, Desf., S. Eur.
  - javanicum, Blume, Java.
  - minus, L., Eur.
  - — Indian form.
  - — var. affine, (Jord.).
  - — var. collinum, (Wallr.).
  - — var. elatum, Regel.
  - — var. flexuosum, (Bernh.).
  - — var. kemense, (Fries).
  - — var. mucronatum.
  - — var. pubescens, Schleich.
  - — var. squarrosum, (Steph.)
  - trigynum, Fisch., Dahur.
- Thermopsis lanceolata, R.Br., Siberia.
  - montana, Nutt., N. Amer. (fabacea, DC.)
- Thlaspi arvense, L., Eur.
  - latifolium, Bbrst., Caucasus.
  - perfoliatum, L., Eur., Caucas.
- Thymus lanceolatus, Desf., Greece.
  - Mastichina, L., Spain, etc.
- Tiarella cordifolia, L., N. Amer.
- Tigridia Pavonia, Pers., Mexico.
- Tolmiea Menziesii, Torr. et Gray, N. Amer.
- Tordylium maximum, L., Eur.
- Tovaria. (*See* Smilacina.)
- Trachelium cœruleum, L., N. Afr., etc.
- Tradescantia erecta, Jacq., Mexico.
  - virginica, L., N. Amer.
- Tragopogon crocifolium, L., S. Eur.
  - (Geropogon glabrum, L.), S. Eur.
- Tridax bicolor, Gray., var. rosea, Gr., Calif.
- Trifolium agrarium, L., Eur.
  - angustifolium, L., Eur.
  - Cherleri, L., S. Eur.

Trifolium—*cont.*
- hybridum, L., Eur.
- leucanthum, Bbrst., Tauria, etc.
- multistriatum, Koch, Eur.
- pannonicum, L., Eur., etc.
- Perreymondi, Gren., France.
- rubens, L., Eur.
- stellatum, L., S. Eur.

Triglochin maritimum, L., Eur.

Trigonella cœrulea, Lam., Eur., Caucas.
- corniculata, L., S. Eur.
- fœnum-græcum, L., S. Eur.
- hamosa, L., Orient.
- monspeliaca, L., Eur.
- polycerata, L., Eur.

Trinia Kitaibelii, Bbrst., Russia, etc.

Trisetum flavescens, Beauv., Eur.

Triticum monococcum, L., Eur.

Trollius asiaticus, L., Siber.
- europæus, L., Eur.
- — var. Denayanus, Hort.
- Ledebourii, Spr., Siber.

Tropæolum aduncum, Sm., Peru, etc. (T. peregrinum, Jacq. T. canariense, Hort.)
- majus, L., Peru.

Troximon cuspidatum, Pursh., N. Amer. (T. marginatum, Nutt.)

Tulipa australis, Link, S. Eur.

Tunica Saxifraga, Scop., Eur.

Typha latifolia, L., Eur.

Ursinia pulchra, N. E. Brown, Cape. (Sphenogyne speciosa, Know. et West.)
- — var. sulphurea, Hort., Kew.
- anthemoides, Poir., Cape. (Sphenogyne anthemoides, R. Br.)

Urtica dioica, L., Eur.
- elevata Banks, Madeira.
- — var. grandidentata.
- pilulifera, L., Eur.

Vahlodea atropurpurea, Fr., Eur.

Valeriana alliariæfolia, Vahl, Caucas.
- montana, L., Eur.

Valeriana—*cont.*
- officinalis, L., Eur.
- — var. exaltata, (Mikan.)
- — var. sambucifolia, (Mikan.)
- Phu, L., S. Eur.
- — var. aureo-variegata.
- pyrenaica, L., Eur.

Valerianella Auricula, DC., Eur.
- carinata, Loisl., S. Eur.
- eriocarpa, Desv., Eur.
- hamata, DC., S. Eur.
- Morisonii, DC., Eur., Taur.
- olitoria, Mœnch., Eur.
- Szovitsiana, F. et M., Persia.

Veratrum nigrum, L., Eur.

Verbascum Chaixii, Vill., Eur.
- gnaphalodes, Bbrst., Taur., etc.
- phœniceum, L., Eur. Siber.
- — var. ferrugineum, (Mill.)
- pyramidatum, Bbrst., Caucas.
- thapsiforme, Schrad., Eur.
- Thapsus, L., Eur.
- — var. turkestanicum, Regel.

Verbena hispida, R. P., S. Amer.

Veronica anomala, Armstr., N. Zeal.
- austriaca, L., C. et S. Eur.
- — var. pinnatifida, Pohl.
- Beccabunga, L., Eur.
- bellidioides, L., Eur.
- Buxbaumii, Ten., S. Eur., etc.
- corymbosa, Hort., Loud.
- gentianoides, Vahl, Taur., etc.
- incana, L., S. Eur., etc.
- ligustrifolia, Cunn., N. Zeal.
- longifolia, L., C. et S. Eur.
- saxatilis, L., Eur.
- — var. Grievei, Hort.
- serpyllifolia, L., Eur.
- — var. humifusa, (Dicks.)
- spicata, L., Eur., etc.
- Teucrium, L., Eur.
- — var. latifolia, (L.)
- virginica, L., N. Amer.
- — var. japonica, (Steud.)

Vesicaria cretica, Poir., Crete.
- gracilis, Hook., Texas.

Vicia amphicarpa, Dorth., France.
- bœtica, Fisch., Siberia.
- calcarata, Desf., Algiers.
- cassubica, L., Eur.
- disperma, DC., France.
- Ervilia, Willd., S. Eur.

Vicia—*cont.*
  Faba, L., cultivated.
  hirsuta, Koch, Eur.
  Ludoviciana, Nutt., N. Amer.
  narbonensis, L., S. Eur.
  onobrychioides, L., Eur.
  Orobus, DC., Eur.
  pannonica, Jacq., Eur.
  pyrenaica, Pourr., Pyren.
  sativa, L., Eur., etc.
  — var. Morisiana, (Jord.)
  sepium, L., Eur.
  sitchensis, Bong., N. Amer., etc. (V. gigantea, Hook.)
  villosa, Roth., S. Eur.

Viola canina, L., Eur., N. Amer.
  — var. alba.
  cucullata, Ait., N. Amer.
  elatior, Fries., Eur.
  Delabordii, Hort.
  hederacea, Labil., N. Zeal.
  Jooi, Janka, Transylv.
  macedonica, Boiss. et Held., Maced.
  odorata, L., Eur.
  — var. purpurea, Caucas.
  palustris, L., Eur.
  Patrinii, DC., India, etc. (V. primulifolia, Linn. ex parte. V. chinensis, Don.)
  pinnata, L., Alps, Eur., etc.
  pumila, Willd., S. Eur.
  pyrenaica, Ram., Pyrenees.
  sagittata, Ait., N. Amer.
  stagnina, Kit., Eur.

Wahlenbergia capensis, A.DC., Cape.
  dalmatica, A.DC., Dalmatia. (Edraianthus dalmaticus, A.DC.)
  lobelioides, A.DC., Madeira.
  saxicola, A.DC., N. Zeal.

Waldsteinia geoides, Willd., Eur., etc.
  trifolia, Koch, Eur.

Whitlavia. (*See* Phacelia.)

Wulfenia Amherstiana, Bth., Himal.
  carinthiaca, Jacq., Carinth.

Xanthium indicum, Wall., Ind., etc. (X. orientale, L.)

Xeranthemum cylindraceum, Sm., S. Eur.
  longipapposum, F. et M., Persia.

Zacintha verrucosa, Gært., Eur.

Zinnia Darwinii, Hort., Trop. Amer.

Ziziphora capitata, L., Taur., etc.

Zollikoferia Elquinensis, Phil. Chili.

Zygadenus elegans, Pursh, N. Amer. (Z. commutatus, Schult. fil., Z. canadensis, Hort., Z. chloranthus, Richards, Anticlea glauca, Kunth.)

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 27.] MARCH. [1889.

LXXXIV.—FIBRE INDUSTRY AT THE BAHAMAS.

At the request of the Secretary of State for the Colonies, the following correspondence is published in the *Kew Bulletin*, respecting a fibre industry at the Bahamas, in which the Governor, Sir Ambrose Shea, takes a deep personal interest. A supplementary note is added, giving the most recent information which has reached Kew respecting fibres from *Agave* and other plants:—

Colonial Office to Royal Gardens, Kew.

Downing Street,
24th December 1888.

Sir,

I am directed by Lord Knutsford to transmit to you a copy of a despatch from the Governor of the Bahamas, enclosing copies of a circular which he has addressed to the Resident and Assistant-Resident Justices of the Islands, on the present position and prospects of a fibre industry in the Colony, and to state that his Lordship would be glad if a copy of the circular could be inserted in the *Kew Bulletin*.

I am, &c.
(Signed) John Bramston.

The Director,
Royal Gardens, Kew.

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1889.
Price Twopence.

Sir A. Shea to Lord Knutsford.

Government House, Nassau, N.P.,
22nd November 1888.

My Lord,

I have the honour to transmit to your Lordship six printed copies of a circular which I have caused to be addressed to the Resident and Assistant-Resident Justices of the Bahama Islands on the subject of the present position and prospects of a fibre industry which is gradually being adopted by the people with a growing faith in its important bearing on their future welfare.

I am, however, anxious that the attention of capitalists should be directed to the solid attractions of this production, and I know of no investment so free from the speculative element and offering a fairer promise of remunerative results.

With a population so long in a stagnant and somewhat contented state, I feel some outside influence is required to urge this industry into vigorous activity, and your Lordship will confer a great good by enlisting the attention of some leading journal to the information in my letter, and thus attract those whose enterprise it would be so important to have engaged in developing this industry, and whose operations would be exemplary to the native population.

I have, &c.
(Signed) A. Shea,
Governor.

The Right Hon. Lord Knutsford,
&c. &c. &c.

[Circular.]

Colonial Secretary's Office, Nassau, N.P.,
22nd November 1888.

Sir,

I am directed by his Excellency the Governor to call your attention to the important question of fibre cultivation, now so largely engaging the minds of the public, and on which it is essential that the fullest information should be disseminated.

During his Excellency's late absence from the Colony, he was enabled to gather some instructive particulars, which strengthens his faith in the part the fibre industry is to play in the speedy advancement of the Colony.

Through the good offices of the Crown Agents for the Colonies in London, the following statement was obtained from Mr. Thomas Briggs, a gentleman of great authority, to whom a sample of rough rope from Bahamas fibre was submitted for examination. Mr. Briggs states, under date September 3rd, 1888:—" This material I consider equal to very " good Manilla hemp, and worth in the unspun, raw state thirty-six to " thirty-eight pounds per ton, colour excepted, which is not of very great " importance. I consider it to be a very superior article for spinning " in yarns for rope-making, and unless in bulk some ingredient should " be found to counteract its apparent good qualities, it should find a " ready sale at the price I name."

This testimony is highly satisfactory, and in the United States the article is not less fully estimated. It is, moreover, a staple commodity of commerce in which serious variations of value are not to be looked for, and this goes to rid the work of production of uncertain and risky conditions.

With land and climate so adapted for the growth of the Sisal fibre, the plant being indigenous, it is remarkable that the industry had not acquired a practical existence until the Legislature gave it an impetus by the fostering Act of the Session of February last—so little was it generally regarded that the small farmers viewed the plant with despair as a noxious weed they were unable to eradicate. From every part of the Colony we now have gratifying proofs of an awakening and intelligent spirit and of the steady advance in the establishment of the industry, and public faith in its efficiency as an agent of general future prosperity increases as we proceed in the work of inquiry. There are some very interesting statements in a pamphlet recently published by Mr. Stoddart, of Jamaica, who spent some time in Yucatan, where the fibre industry has for some years been prosecuted with conspicuous success, under conditions of soil and climate not more favourable than we have in these Islands. We were aware that the plant is independent of drought, and this is Mr. Stoddart's experience. It was also believed in this Colony that it takes about three years after planting to bring the leaf to a productive state, and this is confirmed by Mr. Stoddart, who also affirms that it will then yield annually for 15 to 20 years without any material outlay on its cultivation. The produce of an acre in full growth Mr. Stoddart sets down at from one thousand to twelve hundred pounds of fibre, and he corroborates the opinion held here that the plant thrives best on rocky and impoverished soil, and that it is shunned by cattle, and consequently free from injury on this account.

Mr. Stoddart's estimate of production, which it is not meant to impeach, admits of a large abatement and yet leaves the enterprise full of promise. At a fair price he makes the money value of an acre about eighty dollars annually, but His Excellency prefers a lower basis of calculation to cover all assumable adverse contingencies. The Governor in this view takes fifty dollars an acre annually, which gives a handsome margin of profit on the cultivation. The return of wheat farming is highly enough placed at 35 bushels an acre, or as many dollars at a reasonable computation of price, and we are thus brought in presence of the extraordinary conclusion that the barren lands of the Bahamas, through the fibre cultivation, are made to bear an economic value beyond the favoured wheat-growing regions of the United States and Canada. We moreover find this difference enhanced by the fact that the fibre needs but one planting for 15 to 20 crops, while wheat must be planted annually, and is liable to many injurious contingencies from which the Sisal plant is exempt.

These islands should be the Paradise of the working man. The land is obtainable on very easy terms, and in lots to meet the circumstances of the labouring population. To create the largest possible number of peasant proprietors is the great desire of the Government. But it is not their intention to lead the people away from their present pursuits, for the new industry can be combined with those existing, as it will involve little more than the use of the time now left on their hands. There are nearly 2,000,000 acres of ungranted lands in the Colony, and with the conditions of purchase, the facilities for prosecuting the fibre cultivation and its value as a staple article of commerce, the countries are few that offer so fair a field for the reward of the capital and labour that may seek investment in this undertaking.

It is intended immediately to despatch a Commissioner from this Government to Yucatan to make further inquiries, as it is of the utmost importance to have the fullest information on the whole economy of the industry, in which the people of this Colony are now so vitally interested.

I am, &c.
(Signed) E. B. A. TAYLOR,
Colonial Secretary.

[It is desirable to add a few words to supplement the information given in the interesting circular issued by the Government of the Bahamas.

This information is very similar (with the exception of one or two points to be mentioned later) to that already published in the *Kew Bulletin* for March 1887, pp. 3–8.

Mr. Stoddart's report (published by the Government of Jamaica) on which the estimates of profit in Mr. Taylor's memorandum are based, was communicated by Kew to the Colonial Office for transmission to the Goverment of the Bahamas in reply to a despatch from Governor (Sir Henry) Blake, dated 24th January 1887.

It was pointed out at the time in par. 5 of the Kew letter, dated 15th February 1887, that "the statements contained in the pamphlet are not "necessarily endorsed, either by the Government of Jamiaca or by "Kew. It professes to be nothing more than an account given by a "Jamaican resident of the fibre industry in Yucatan in which he was "practically engaged for some time."

It is to the credit of Mr. Stoddart, however, that his account of the fibre industry of Yucatan is confirmed in most particulars by other writers, and there is no reason to believe that it requires correction in any essential part. It may at the same time be desirable to point out some of the conditions under which the industry is remunerative in Yucatan.

For instance the rates of wages in Yucatan are comparatively low (ranging from 9*d.* to 1*s.* per day for labourers), and under such circumstances, Mr. Stoddart estimates (at page 10) the net profit on current expenses at "between 4*l.* and 5*l.* per acre" (equal to between 20 and 30 dollars per acre). The plants, if 18 inches high when first put out, are said to be ready for a first cutting in three years. This period may, however, under unfavourable circumstances, be prolonged to five or six years. Another important point to bear in mind is that Mr. Stoddart speaks only of returns obtained by the use of machines driven by steam-power, and by working plantations of say 100 acres or more. The methods suited to one country are not necessarily suited to another. Possibly at the Bahamas it might be advantageous for small cultivators to clean the fibre in their leisure hours by hand, and sell it locally to merchants who would ultimately undertake the business of baling and shipping it. If the fibre is not properly baled, the cost of freight would be so large as to greatly reduce the returns. Indeed the fibre in a loose state is so bulky that it would be almost impossible to ship it at such a rate as would enable it to compete successfully with fibres from other countries. It is usual to pack this class of fibre by means of hydraulic presses, in bales of about 400 pounds each. If the small proprietors in the Bahamas take up a fibre industry, it is evident that some one possessing capital should be prepared to purchase the fibre in small quantities and pack it by means of suitable presses ready for shipment. There are no grounds, however, for supposing that a fibre industry based on *Agave* and *Furcræa* plants, and judiciously pursued, can be otherwise than satisfactory.

A collection of fibre plants was received at Kew about two years ago from the Government of Bahamas, and it was stated in a letter dated the 16th May 1887, that among these specimens there is no species exactly answering to that yielding the Sisal Hemp of commerce. The fibres of No. 2 (*Furcræa cubensis*), and No. 3 (*Furcræa cubensis*, var. *inermis*), are the most valuable, and these are used partly as a source of commercial fibres in Yucatan. The true Sisal Hemp plant is *Agave rigida*. This may be abundant in the Bahamas, but no specimens were received of it. Other fibre plants received at the time mentioned were *Agave lurida* and *Agave americana* var. *variegata*, the latter a variegated form of the common American Agave. These latter are of little value for fibre as compared with the true Sisal hemp plant. Specimens of African bow-string hemp (*Sansevieria guiniensis*) were also received, the fibre of which is of high value.

A fibre industry has been in existence in Mauritius for some years. The experience gained there might be of service in the Bahamas, especially in regard to the initial difficulties to be overcome in establishing a new industry.

The market value of this class of fibre, and the permanency of demand for it, has been fully investigated at Kew, and in a note on p. 3 of the *Kew Bulletin* for April 1887, there is a summary furnished by Messrs. Ide and Christie, which gives the average price per ton for Sisal hemp in London for the years 1879–86 inclusive. These are 1879, 27*l.*; 1880, 27*l.*; 1881, 28*l.*; 1882, 28*l.*; 1883, 27*l.*; 1884, 21*l.*; 1885, 19*l.*; 1886, 21*l.* The highest price paid was 32*l.* 10*s.* 0*d.* in December 1879 to February 1880, the lowest price was 17*l.* 15*s.* 0*d.* in January and February 1886. Recently there has been an increased demand for white fibres, with a corresponding rise in prices. There were no quotations for Sisal hemp in Messrs. Ide and Christie's London Monthly Circular for December 15th, 1888. The only remark being "in retail supply, and selling at fancy prices." In the United States, Messrs. Crocker's Statistics, dated the 1st December, gave the price at 8 to $8\frac{3}{8}$ cents. per lb. (equal to about 37*l.* to 39*l.* per ton). A rough Agave fibre from Bombay (probably prepared by hand) was valued last December at 15*l.* to 17*l.* per ton. Mauritius hemp prepared by machinery from *Furcræa gigantea* (known as the green aloe or green Agave) was valued: good, 34*l.* to 35*l.* per ton; fair, 33*l.* per ton; common, 30*l.* per ton. D. M.]

LXXXV.—HARDY SPECIES OF EUCALYPTUS.

It is well known that some species of Eucalyptus are hardy in certain districts in this country, but the ordinary Blue Gum, *E. Globulus* is only sparingly so. We have recently received from Mr. F. Abbott, Superintendent of the Botanic Gardens at Hobart Town, Tasmania, a small quantity of seed of this species collected from trees growing at high altitudes and exposed to severe frosts. Seeds were also received of *E. coccifera* from trees which were coated with icicles "a foot long." It is probably that plants raised from seed of such hardy forms would be likely to bear with impunity the rigours of an English winter. The seed received has all been sown and the results will be duly noted later. In the meantime the following extract from a letter received from Mr. Abbott will be read with interest :—

In the same package I put a little seed of *Eucalyptus Globulus* from Tullochgorum, a part of the Colony where the winters are severe, and on that account the plants raised from the seed forwarded are likely to withstand an amount of cold that would kill the ordinary form, at all events it is so here, as all attempts to introduce the plants into the district from the southern parts of the island failed, the cold proving too severe. Eventually a few isolated plants of *E. Globulus* were found growing in a sheltered gully some 20 miles from Tullochgorum. These were the only plants of the species that have been found growing naturally in so cold a climate, and plants raised from these trees were planted about Tullochgorum, and grew into large trees, without ever suffering from the severe frosts so prevalent in the district which has always killed plants brought from the warmer parts of the island. It would therefore be well worth while to give any seedlings you may raise from the seed sent a fair trial, with a view of proving whether this particular variety is sufficiently hardy to withstand the cold of an English winter. It will not be possible to obtain much seed, but any I may get I will forward to you, as you will have a better opportunity of testing it. I have a little more drying out which will be forwarded as soon as it is ready. I send with this a little seed of the hardy *E. coccifera* which I have seen on the top of Mount Wellington completely coated with ice, and shielded with icicles a foot or more long hanging from the branches. I have no seed of *E. verrucosa* at present, but will get some as soon as possible. This is a very dwarf species, usually under 4 feet, and at best is very sparing at producing seed. I have no doubt it will be hardy.

LXXXVI.—YAM BEAN.

(*Pachyrhizus tuberosus*, Spreng.)

With Plate.

In the *Kew Bulletin* for January last, p. 17, an account was given of the interesting economic plant known as Yam Bean (*Pachyrhizus tuberosus*, Spreng). It was then mentioned that a figure and description of the species was in course of preparation for the *Icones Plantarum;* and by permission of the Bentham Trustees this figure is now reproduced in the *Kew Bulletin.* The only previous figures of this plant appear in Plumier, *Plant. Amer.*, pl. 220, and in Descourtilz, *Flore des Antilles* (1829), viii., p. 127, pl. 554. As these old works are not readily accessible, the present figure will prove of interest and afford a means of comparison with *P. angulatus*, Rich., a figure of which will appear later.

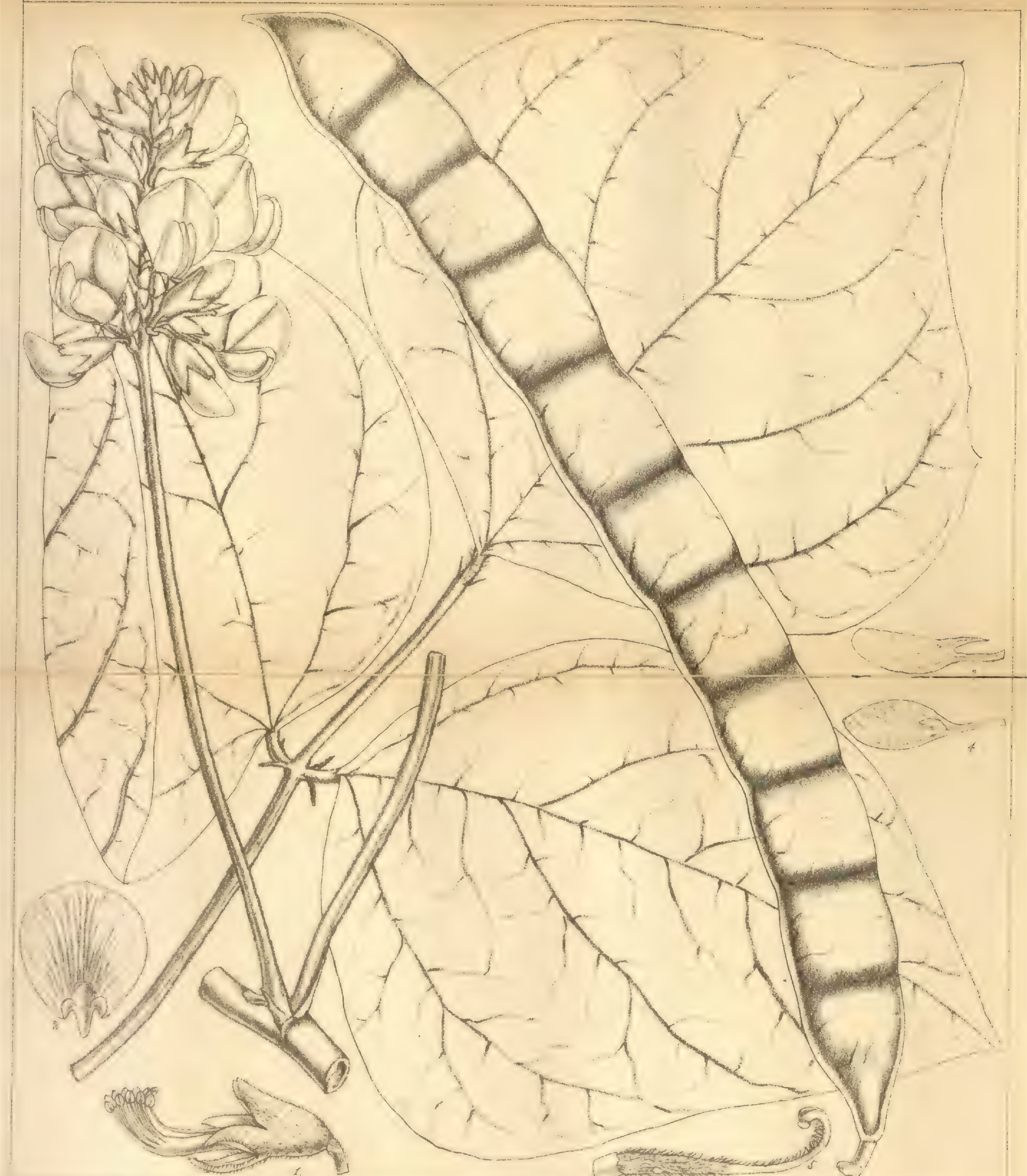
Pachyrhizus tuberosus, Spreng. Syst. Veg. IV., pars. 2, 281. Roots tuberous. Stem herbaceous twining 10–20 ft. (Spruce). Leaves pinnate, 3-foliolate, long-petioled, stipules linear lanceolate; leaflets broadly rhomboid-ovate pointed entire or obscurely sinuate, in young specimens sometimes shallowly lobed, terminal leaflet broadly cuneate at the base, lateral oblique, stipels subulate. Racemes sub-compound, lower branches very short, with flowers in fascicles. Calyx 5-lobed, lobes as long as the tube, superior shorter. Corolla white (Trimen). Legume 8–12 inches long, 9–10 lines broad, slightly hairy when young compressed somewhat bent, with deep transverse depressions between the red black or pale spotted seeds.

The specimens in the Kew Herbarium are all apparently from cultivated plants.—Tarapota, Spruce (4936), from Dr. Ernst, Caracas, and recently from Dr. Trimen, of the Botanic Garden, Peradeniya, Ceylon.

Professor Oliver states that "it may be a question how far this "plant is specifically distinct from *Pachyrhizus angulatus*, Rich. "Mr. Bentham regarded Spruce's specimens from Peru as belonging to "this species. I think it may well be a variety originated under cul- "tivation, but so marked as to require a distinct name for cultural "purposes, and for the present the specific name given by Lamarck "may suitably be adopted."

In a letter dated Caracas, 2nd February, Dr. Ernst supplies the following additional information :—

With respect to *Pachyrhizus tuberosus*, which I had in cultivation or some time, I must say that in our form the flowers are bluish violet, the



M.S. del. et lith.

Pachyrrhizus tuberosus, Spr.

pods about 15–20 cm. long and 15 mm. broad and the seeds dull black. I am very sorry I have no pods left. I sent all the ripe seeds I had to Professor Flückiger at Strassburg in order to have their toxic proprieties duly investigated; but I have not received any information about the result from him, although he wrote me he had given the seeds to one of his assistants for the purpose indicated. I think I wrote you that the seeds (in decoction or in form of powder) are used in Merida (Venezuela) for killing vermin. You are quite right in saying that toxic properties have been noticed in several species of beans. Only a few days ago one of my former pupils wrote to me from the State of Táchira that he had seen a case of poisoning with a kind of bean called here *tapiramo* (a species of Dolichos). The cooks have a rule to throw away the first water in which these tapiramo have been boiled. It is certainly of a disagreeable taste. I should say that there is a substance like lupinin in the seed-coats.

You sent me once seeds of Pachyrhizus [probably *P. angulatus*] from an East Indian garden. The plants grew, but I was unfortunately not in Caracas when they flowered. I have been told by my man that the flower was reddish-white. I have a few pods of these plants which I send you to-day. They are much smaller than those of our indigenous species.

Fig. 1. Calyx and stamens. 2. Vexillum. 3 and 4. Carinal petal. 5. Pistil.—*Enlarged.*

LXXXVII.—WEST AFRICAN RUBBERS.

The information contained in the following correspondence and papers in respect to West African Rubbers may be usefully perused in continuation of that already published in a recent number of the *Kew Bulletin* (November 1888, p. 253):—

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, 17th June 1887.

I AM directed by the Marquis of Salisbury to transmit to you herewith certain samples of india-rubber which have been obtained from a district under British protection to the West of the Rio del Rey, by Mr. H. H. Johnston, British Vice-Consul at Old Calabar, during an exploration made by him of that region, and I am to desire you to submit the samples in question to an examination by some specialist in order that their quality and value may be tested, and to report the result to this Department.

I am, &c.,
(Signed) T. V. LISTER.

W. T. Thiselton Dyer, Esq., C.M.G., &c.
Royal Gardens, Kew.

MR. S. W. SILVER, F.L.S., to ROYAL GARDENS, KEW.

3, York Gate, Regent's Park, N.W.,
27th July 1887.

DEAR SIR,

REFERRING to mine of the 29th ultimo, I have the pleasure to forward a copy of the report from our chemist at Silvertown with samples showing the results, and to state that sample No. 2 has a market value of 1*s.* per lb.; No. 3 (dark) 1*s.* 6*d.*, No. 3 (light) 1*s.* 10*d.* and 2*s.*; No. 5 about 2*s.* 3*d.*

I am, &c.
(Signed) S. W. SILVER.

D. Morris, Esq.,
Royal Gardens, Kew.

REPORT of the INDIA RUBBER, GUTTA PERCHA, AND TELEGRAPH WORKS COMPANY, LIMITED.

Silvertown, 21st July 1887.

Description, &c.—Four samples of india-rubber were received, marked respectively No. 2, No. 3, No. 3 (dark), and No. 5.

The samples marked No. 3 have been dealt with as duplicate samples of the same rubber. Sample No. 2 was black and sticky on the outside due to oxidation, the freshly-cut surfaces were slate-grey colour. The rubber was firm and non-adhesive to the fingers. The samples marked No. 3 differed slightly in appearance, one was much darker than the other. The darker sample evidently would be more prone to decay than the lighter sample, but still both samples are remarkably good for African rubber. Both these samples consisted of agglomerated tear-like masses, with red and pinkish particles strongly resembling rubber, Evidently, if these samples are from the same plant, the difference in colour of the tears must be due to the incision or puncture extending to different tissues. The light-coloured particles were very similar to good Ceara rubber. The freshly-cut surfaces of sample No. 5 were whitish in colour. It was very similar to the better specimen of No. 3, and as a raw article is quite equal to the best kinds of Brazilian rubber. On so small a sample, it would be difficult to say how it would behave in general manufacture. The behaviour of a specimen under manipulation is of primary importance in fixing its commercial value. However, this specimen is far above the best kinds of African rubber.

In Manufacturing, &c.—No. 2 lost 14·5 per cent. on washing and drying, becoming sticky and of course difficult to treat in the ordinary way. In quality it is very low, being inferior to flake African. Mixed with a suitable proportion of sulphur it vulcanized fairly well and free from sponginess. It would hardly be suitable for working by itself, but with firmer kinds of rubber it would mix well and yield a product suitable for many low class manufactures. The two samples marked No. 3 lost 5·6 per cent. on washing and drying. The samples were mixed together and behaved very well in grinding and mixing. It vulcanizes very well in being elastic, firm, and solid. In this stage it takes a dark colour, but is not offensive in smell.

No. 5 sample gave a loss of 8 per cent. on washing and drying. It vulcanizes very well, although dark in colour. Its smell is not offensive but strong.

Remarks.—As a rule the African rubbers give dark products on vulcanizing, and many of them have an offensive odour, which arises no doubt from the action of sulphur, in vulcanizing, on some principle contained in the natural sap of the plant yielding the rubber.

Messrs. Taylor, Laughland and Company, of Glasgow, recently forwarded specimens of West African rubber with a letter of which the following is an extract:—

One of our agents in Old Calabar, West Africa, has collected and sent us a few samples which he is very anxious to get classified, and thinking that you would help us in this, we have sent to-day to your address per Globe Parcel Express, carriage paid, a parcel containing these samples as per enclosed list. He is anxious to get the natives to cultivate the rubber vine and make rubber more freely. He says he has been up the country and finds the various kinds of rubber vines in great abundance, but no rubber is taken from them, as until quite recently the natives did not know that there was any value in it, and even now they do not know how to make the rubber from the juice. In order to teach them and secure the best plants, he has sent home specimens of the leaves of four common kinds of vines with the native names, and if you can give us the scientific names we shall feel much obliged. He sends also the rubber from them, but, as you will see, it is very badly made. Can you say which is the most valuable of these four vines?

Three of the four specimens sent were wholly inadequate for any determination. But one called Npok was identifiable as *Landolphia owariensis* which is found from Sierra Leone to Angola, and is no doubt the most important source of West African rubber. [*See* Kew Report for 1880, p. 38.]

An investigation into india-rubber milk received at Kew from the Niger delta is described in the following correspondence:—

38, Elthiron Road, Fulham, S.W.,
14th September 1888.

Dear Sir,

Several gentlemen to whom I have applied for information about india-rubber have recommended me to communicate with you. I therefore venture to ask if you can help me, and trust you will pardon me for intruding on your valuable time. To explain myself fully, let me say that I have for some years been trading on the West Coast of Africa, in the oil rivers (the deltas of the Niger). For some time past we have been endeavouring to introduce and foster the india-rubber trade, and have been partially successful. There are quantities of rubber trees and vines, but the natives of these districts, having hitherto never cultivated the article, are quite ignorant of the mode of preparing the milk obtained from these trees and vines to convert it into a commercial form. We are quite certain that this matter will open a wide field of commerce to the benefit of the native, the trader, and the consumer, if we could learn the mode of treatment. What I wish to ask you is if you can inform me of the best mode of congealing the milk as it is obtained from the tree. Accompanying this I send you a small sample of rubber milk in its natural state. Should you deem it worthy of your notice, I will most gladly furnish you with a larger sample for experimental or other purposes.

I am, &c.
(Signed) James S. Cockburn.

W. T. Thiselton Dyer, Esq.,
Royal Gardens, Kew.

Royal Gardens, Kew, to Mr. James Cockburn.

Sir,
Royal Gardens, Kew, 2nd November 1888.

I beg to forward herewith a copy of a report received from S. W. Silver, Esq., F.L.S., on the sample of rubber milk from the Delta of the Niger which you recently forwarded to this establishment.

2. I regret to notice that this substance is not of a character likely to be of use in commerce, and the results of the experiments are such as

preclude any hope of solving the question of coagulating the milk in a satisfactory manner on this side.

3. If we had specimens of the leaves, flowers, and fruit of the tree from which the milk was obtained, we might then be in a position to suggest a treatment that would afford satisfactory results. At present we have no data upon which to work, and the matter cannot be carried any further.

4. We would suggest that steps be taken to procure specimens of leaves, flowers, and fruit of all rubber plants in the district in which you are interested, and we enclose instructions for collecting and preparing such specimens, so that they might arrive in this country in a suitable state for examination.

I am, &c.
(Signed) D. MORRIS.

J. Cockburn, Esq.

(Enclosure.)

REPORT of the INDIA RUBBER, GUTTA PERCHA, AND TELEGRAPH WORKS COMPANY, on SPECIMEN of INDIA-RUBBER MILK from WEST COAST OF AFRICA.

Silvertown, October 26, 1888.

THE contents of the tin were strongly acid; on pouring out the same it was found that the tin contained a large quantity of already coagulated gum, which could only be removed by cutting off the lid. The part coagulated was treated by itself. The portion still liquid was emptied into open dishes, so as to cause a further separation of coagulum by evaporation. The portion which separated in this case was treated by itself. Both products were very sticky, and became more so as the washing process was continued; they ultimately became quite unmanageable for the subsequent stages of drying, &c.; the substance is quite unsuited for any ordinary india-rubber manufacture.

By destructive distillation it does not yield caoutchoucene, which is the principal characteristic of caouchouc or india-rubber. The distillate more closely resembles in smell that of some principles, balsams, &c. which yield cinnamic acid. This is highly characteristic and of value in determining the suitability of a lactescent juice as a mercantile source of caoutchouc. The most suitable way of obtaining the coagulum from this juice is by leaving the same exposed in open vessels, and collecting what forms on the surface from time to time so as to increase the chance of further evaporation, &c. If it be intended to send these natural juices for examination it will be best to add ammonia freely, so as to neutralise any acid which may be generated whilst in transit.

The Resident Manager adds: "We do not see our way to make use " of this material. We quite agree with your remarks to Mr. Morris " as to the chemical change in these juices that takes place before they " can arrive in this country."

LXXXVIII.—PHYLLOXERA IN ASIA MINOR.

The introduction of the Phylloxera into Asia Minor was reported to the Foreign Office by Acting Consul-General Barnham from Smyrna in June last.

The introduction of this terrible pest into this part of the world appears not to have been an accident, but the result of a deliberate importation of vine plants from a country where the disease was known to exist. Persons engaged in horticultural business often complain bitterly, and sometimes with good cause, against the restrictions which the Phylloxera regulations impose upon them. But in the face of the facts detailed in the following correspondence it is difficult to find grounds for protesting against such regulations :—

ACTING-CONSUL BARNHAM to FOREIGN OFFICE.

MY LORD, Smyrna, 4th June 1888.

I HAVE the honour to confirm my telegram of the 2nd inst., by which I informed your Lordship that Phylloxera had attacked the vines in the neighbourhood of Smyrna.

The disease has been discovered in certain vineyards between Smyrna and Bondjah, and in others between the Bondjah road and the village of Koukloudja. The full extent of the evil is, however, probably greater.

Messrs. Müller and Suppa, of the German wine factory, who are considered the best authorities on the subject in Smyrna, report that the Phylloxera which has now appeared is that known as wingless insect with suckers, which is found embedded in the lower roots of the vine, presenting to the naked eye the appearance of small yellow specks, but fully revealed by the aid of ordinary magnifying glass. In all its details it corresponds with the form of Phylloxera which is found at this season of the year.

The advanced appearance of the disease, and the evidence given by the villagers upon the subject, have led these specialists to conclude that Phylloxera has already existed in the neighbourhood for two years.

The appearance of Phylloxera is justly regarded as a great calamity in this district. It will inflict ruin upon hundreds of families which have no other means of support than the produce of their vineyards, and inflict a terrible blow upon a branch of export which was estimated in 1886 as high as 1,540,340*l*.*

The only remedy which suggests itself is that the vineyards affected should be destroyed, and that the authorities should permit the introduction of American plants, which, being tougher, are better calculated to resist.

A Government Commission has been appointed to investigate the matter, and I will report as soon as possible.

I have, &c.
(Signed) H. D. BARNHAM,
Acting Consul-General.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

Acting-Consul BARNHAM to Sir W. A. WHITE.

H.M. Consulate, Smyrna,
SIR, 21st June 1888.

WITH reference to my despatch No. 31, of the 4th instant, I have the honour to report that the local authorities are endeavouring to prevent the spread of Phylloxera by the total destruction of the affected vineyards. No official report has yet appeared upon the labours of the Commission, but the following information is authentic. It has been decided that the vine-growers whose property is doomed shall receive ten Turkish pounds per dunum as compensation, and that as there are no municipal funds from which this money could be drawn, a tax of one piastre shall be levied on every hundredweight of raisins offered for sale in Smyrna and the neighbouring ports, or in other words, an increased tithe to that extent.

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* ? Piastres 1,540,340 = £140,300.

It appears certain that the Phylloxera has existed here for at least three years, and the Commission have obtained evidence that it was introduced by the German vine-growers, Messrs. Müller and Suppa. Three or four years ago these gentlemen are said to have introduced a German vine, highly prized by connoisseurs, but which contained Phylloxera.

Certain of the villagers declare that on the introduction of these plants they stole some of them and replanted them in their own grounds, and wherever they were transplanted the disease has appeared.

Should the local authorities apply to me for permission to examine the vines of British subjects, I will, subject to your Excellency's approval, give that permission whenever the authorities can give *primâ facie* evidence that the presence of Phylloxera is probable, and of course, if affected, the vines of British subjects must be treated as those of other subjects.

I have, &c.
(Signed) H. D. BARNHAM.
Acting-Consul General.

The Right Hon. Sir W. A. White, G.C.B.,
&c. &c. &c.

Sir W. A. WHITE to FOREIGN OFFICE.

Constantinople,
9th February 1889.

MY LORD,

I HAVE the honour to enclose herewith copy of the article which appeared in the "Levant Herald" respecting certain measures of precaution adopted by the Turkish Government against Phylloxera, of which mention was made in your Lordship's despatch No. 7, Commercial, of the 17th ultimo.

From inquiries that I made at the Ministry of Commerce with a view to ascertaining what measures the Imperial Government had taken against Phylloxera, I learnt that the Ministry had endeavoured to treat the diseased vines in the neighbourhood of Srenkein (near Constantinople) with bi-sulphide of carbon, the means usually employed in France and Algeria, but that owing to special and independent causes, these measures had not been carried out in their entirety; secondly, that the same means had proved most successful at Smyrna and the neighbourhood, where Nouri Bey, Director of Agriculture, had himself superintended the operations; and thirdly, that vines in the district of Smyrna, being mostly planted on land capable of submersion, the Ministry of Commerce had made a proposal to the Porte, that vine owners who should consent to their vines being submerged annually for 40 days, should be exempted from taxes for a certain period, and in general should receive all possible encouragement.

Nurseries of vine-plants procured from America, from which healthy cuttings can be obtained by cultivators, have already been established in districts where the vines have been affected by Phylloxera.

I have, &c
(Signed) W. A. WHITE.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

LXXXIX.—BOTANICAL STATION AT LAGOS.

In the *Kew Bulletin* for June 1888, p. 149, an account was given of the establishment of a Botanical Station at Lagos, West Africa. This is the first effort of the kind made in that part of the world, and it is very gratifying to find that under the control of the Governor, His Excellency Captain Moloney, C.M.G., the result attained is most creditable to all concerned. The following official correspondence respecting this Station has lately been received at Kew:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

Downing Street,
20th December 1888.

SIR,

I AM directed by the Secretary of State for the Colonies to transmit to you for any observations you may have to make, a copy of a despatch from the Governor of Lagos, forwarding a report on the Botanic Station for the quarter ended 30th September 1888.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director,
Royal Gardens, Kew.

Governor MOLONEY to LORD KNUTSFORD.

Government House, Lagos,
12th November 1888.

MY LORD,

IN continuation of my despatch No. 273, of the 3rd ultimo, I have the honour to transmit copies, as per margin of the fourth report, on the Botanic Station of the Colony of Lagos for the quarter ended 30th September 1888.

Your Lordship will observe that the reasons advanced at the end of 1886, in favour of the establishment as a branch of this Government of a Botanic centre in this Colony have been within a year supported by the attainment of the objects on account of which the institution was advocated.

The Superintendent's enthusiastic interest and good work have been as noticeable as in previous quarters, and satisfactory progress continues to be made.

Since May last there have been issued from the Botanic centre 9,326 plants, of which 7,096 were coffee.

Under sale of plants the treasurer has received as revenue to the close of October, the sum of £20 7*s*. 1½*d*.

At the end of September the cocoa nut seed planting of the Government reached 31,483. It is intended to establish permanently in the Eastern and Western Districts, at the beginning of the next rainy season, plantations to the extent of 30,000 trees, the fruit of which in time should be worth £6,000 per annum to the Government; further, to continue, in the future, the nursery work to keep a supply of seedlings on hand to replace failures, and for distribution among the people, in exchange for seed nuts, or by purchase at the low rate of 1*d*. each.

It will be not without interest to mention here that the Government has recently received an order for 1,000 seedlings for a cocoa-nut plantation, contemplated at the south-east end of the island of Lagos.

In favour of the further extension to West Africa of the Botanic Station scheme, this Government will be prepared to educate and train up, for the bare return, cost of maintenance, and clothing in each case, apprentices as sub-gardeners from any of he sister Colonies, whether for Governmental or private enterprise.

I have, &c.
(Signed) ALFRED MOLONEY,
Governor.

The Right Hon. Lord Knutsford,
&c. &c. &c.

EXTRACT from REPORT on the BOTANIC STATION, LAGOS, for Quarter ended 30th September 1888.

For the period under review the Superintendent has paid special attention to nursery work in general, such as propagating plants by seed and cuttings, potting, preparation of seed beds, &c. The service of putting plants in their permanent places has also proceeded, as well as that of laying out new walks, of forming grass borders, &c. Fifty-five plants have been put in their permanent places, viz., 30 ornamental, one fruit, four roses, and 20 economic.

The cacao plants and Liberian coffees have thriven well under the shade of West Indian castor-oil plants and banana trees. The arnotto plants in permanent places continue to look healthy; several shrubs have borne fruit, and the Superintendent will be able shortly to propagate therefrom a large quantity of plants. An important part of the original scheme for this station has been carried out by the establishment of a model kitchen garden in the north-west corner of the garden. Twenty large beds have been laid out and planted. A contractor has been found to take for one quarter the vegetables in excess of the requirements of the Superintendent, at a nominal rate of 2*l.* per month; they are exposed by the contractor for sale, every morning, on a moveable stall, erected for the purpose by the Government at the meat market. Later it is intended by the Government to call for tenders for the service of sale of the produce. The issue of plants from the garden for this quarter reach a total of 4,569; of this number 3,770 were purchased, and payment to the sum of 7*l.* 17*s.* 1*d.* made accordingly into the Treasury; the balance represented free issues.

In accordance with a desire conveyed to introduce the best sorts of pine apples for cultivation at Lagos, the Director of the Royal Gardens, Kew, has been good enough to obtain, with some trouble, suckers from the Mentmore Gardens, England. The following were the varieties locally received on the 15th July last:—three "Queen"; three "Lord Carrington"; three "Charlotte Rothschild"; three "Smooth Cayenne."

With reference to cocoa-nut planting industry that proceeds in the hands of the Government, the following represents the seed planting in the districts for the quarter:—Leckie, Eastern District, 1,185; Palma, Eastern District, 600; Badagry, Western District, 7,409; total 9,194.

The plantations to the extent of 30,000, as contemplated to be laid out early next year in the eastern and western districts, should, when generally bearing, be worth to the Government 6,000*l.* per annum. Further, it is intended to continue in the future the cocoa-nut nursery work of the districts, and keep a supply of seedlings on hand to replace failures, and for distribution among people in exchange for seed nuts or by purchase at the low rate of 1*d.* each.

The stage of development at which the garden has arrived can be gauged from the list embodied in this report of plants at the Botanic Station, on the 30th September 1888. To promote a wider distribution of plants, and to extend the means of industrial education afforded by the station, it is hoped by the Government that in time branches of the nursery department may be established at Badagry and Leckie, with a trained sub-gardener in charge of each, under the control and direction of the respective Commissioners.

The exports from the Colony during the quarter of palm kernels, palm oil, cotton, beniseed, coprah, gum and rubber were as follows:—Palm kernels, 13,226 tons; cotton, 46 tons; beniseed, 4½ tons; coprah, 1¾ cwt.; ogea gum, 9 tons; rubber, 1¼ cwt.; palm oil, 287,371 gallons.

For instruction, in accordance with the original scheme, there was introduced on the 14th September, into the garden, one Gbami, the nephew of Chief Manuah of Itebu.

In favour of the further extension to West Africa of the Botanic Station scheme, this Government will be prepared to educate and train, for the bare return of the cost of maintenance and clothing in each case, apprentices as sub-gardeneis from any of the sister Colonies whether for Governmental or private enterprise. The Governor and his staff have made several visits to the garden during the quarter. The other visitors to the garden numbered 69 persons, of whom 30 were white and 39 black; besides Government officials, they were chiefly made up of ladies, clergymen, and other professional gentlemen, merchants, traders, &c.

XC.—CHIGA BREAD.

(*Campsiandra comosa*, Benth.)

An interesting inquiry has been carried on by Dr. Ernst of Caracas, respecting the plant yielding Chiga flour or Chiga starch used in the tropical parts of South America for making bread. The investigation is described by Dr. Ernst in letters addressed to Kew as follows:—

Caracas, 8th November 1886.

I SEND you to-day a little tin box with three seeds of the *Chiga*-tree, and likewise a sample of the starch prepared from them.

This tree is, as far as I know, not yet known scientifically, although Humboldt mentions it already in his *Personal Narrative* (Vol. VIII., page 312, note). He says, "Une autre espèce de mimosacée que nous " avons rapportée (le *Chiga* des Ottomaques et le *Sepa* des Maypures) " donne des graines dont la farine est mangée à Uriana comme du " manioc. C'est de cette farine que l'on prépare le *pain de chiga* qui " est commun à Cunaviche et sur les bords du Bas-Orénoque. Le " *Chiga* est un espèce d'*Inga*, et je ne connais point d'autre mimosacée " qui suplée aux céréales."

Although Humboldt says that he brought the species from the Orinoco to Europe, there is no mention of it in the botanical part of his great work, so that we must suppose that the specimen either got lost or was quite insufficient for being described.

Nor is there any other mention of this curious plant in any of the botanical publications on the flora of this country, at least as far as I have been able to ascertain.

I obtained in 1872 samples of Chiga starch, and since that time tried in vain to obtain specimens of branches with flowers and fruits for botanical identification. In 1883, there was a fine sample of Chiga starch in our National Exhibition; I have it still in the Museo Nacional, and from it is the small quantity I send you. Of course your are welcome to more.

I applied to the gentleman who had sent this starch for getting a botanical specimen; and after a delay of more than three years, he has finally been able to obtain one fruit and 12 isolated seeds. The fruit I keep in our museum; of the seeds I offer you three; it is very little, but perhaps sufficient for an approximate identification.

The fruit is a true legumen, about 6 inches long, and 2 broad; the base is somewhat contracted, the apex rather blunt. The valves are perfectly smooth, and plain; there is no thickened margin close to the sutures. The valves are thin, of a consistency like parchment, and quite smooth inside. The splitting begins on the distal end, and there is some spiral twisting as far as they separate from each other. The fruit contained four full-grown seeds and an abortive one; the former lay close to each other, somewhat overlapping each other with their flat margins.

I have been informed that the tree grows generally by the banks of rivers, and produces abundant crops. The seeds are taken out of the pods and buried for some time in damp soil; then after a certain degree of fermentation has set in they are taken out, washed, and pounded. The flour or starch is used, just as Humboldt says, even to-day for bread-making, especially for a certain kind of little tarts, which are said to be very good to eat. I had one made here in my house; but I must confess that I found its taste rather indifferent and somewhat mouldy. However, this may have depended on the flour being too old.

It appears to me that the *Chiga* cannot be a species of *Inga*, at least in the extension in which this genus is considered to-day. After a very careful search in the *Genera Plantarum* I cannot find any genus which agrees well with the material before me. The structure of the seed, with the spongy central part of the integuments and the winglike margin all round, is rather exceptional in *Leguminosæ*, and were it not that I have seen the seeds adhering to the ventral suture of a half-opened pod, I should have thought they belonged to a bignoniaceous genus.

The spongy structure of the integuments may have some biological meaning. As the tree is said to grow close to the water of rivers, the seeds will frequently fall into the water, where they will float easily on account of their sponginess, and reach in this way a suitable spot for their germination.

Spruce states, on the label of a specimen of *Campsiandra laurifolia*, Benth., in the Kew Herbarium, that "on the Orinoco this, or a closely " allied species of *Campsiandra* . . . affords a considerable part " of the sustenance of certain tribes of Indians. . . . . On the " Rio Negro, in times of scarcity, the seeds of nearly every large-fruited " tree is used in the same way."

In a letter dated 30th January 1888 Dr. Ernst states:—

You remember, perhaps, that some time ago I consulted you about the botanical name of the tree which yields the *Chiga* starch of the Orinoco, mentioned already by Humboldt, who believed it to be an *Inga*. You were so kind to answer me that from the seeds I sent you the plant might be close to *Macrolobium*, and that Mr. R. Spruce suggested *Campsiandra*. Now I am happy to tell you that Mr. Spruce is quite right. I got lately a single flower, which is in every respect in conformity with the description of the same organ given by Poeppig and Endlicher in their *C. rosea* (Walper's Rep. Bot. V., 568).

Finally, we have a letter from Dr. Ernst, dated 2nd February 1889, in which he states that he had at last obtained "one small branch of " the tree yielding Chiga flour, with leaves and flowers. It now proves " to be *Campsiandra comosa*, Benth., and the description given in " Walper's *Repertorium Botanices Systematicæ*, tom. V., p. 568, agrees " in every particular."

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 28.] April. [1889.

NEW GARDEN PLANTS.

The *Kew Bulletin* for April 1888 contained a list of new garden plants described to the end of the year 1887. The present list includes those described and published during the year 1888. It has been extended to include the descriptions of new plants (and name alterations) which have appeared in several horticultural periodicals, that were not included in the former list. The number of new garden plants annually described in various English and foreign periodicals, renders it a matter of considerable difficulty to botanists and horticulturists to keep them in view. The compilation and publication of a complete annual list of new garden plants is indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, as these, for the most part, are only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange.

A full description of hybrids of garden origin, and of garden varieties, is not given, as otherwise the list would exceed the moderate limits within which it is necessary to confine it.

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1889.

Price Twopence.

The publications from which this list is compiled, with the abbreviations used to indicate them, are as follows:—*B. M.*—Botanical Magazine. *B. T. O.*—Bulletino della R. Società Toscana di Orticultura. *Bull. Cat.*—Bull, Catalogue of New, Beautiful, and Rare Plants. *G. C.*—Gardeners' Chronicle. *G. and F.*—Garden and Forest. *Gfl.*—Gartenflora. *H. G.*—Hamburgh Garten-und Blumenzeitung. *Ill. H.*—L'Illustration Horticole. *Jard.*—Le Jardin. *L.*—Lindenia. *L'Hort. Int. Cat.*—L'Horticulture Internationale, Catalogue des Plantes. *O.*—L'Orchidophile. *R.*—Reichenbachia. *R. H.*—Revue Horticole. *Veitch Cat.*—Veitch & Sons' Catalogue of Plants. *Veitch. Man.*—Veitch & Sons' Manual of Orchidaceous Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung. *Williams Cat.*—Williams' New and General Plant Catalogue. *W. O. A.*—Warner & Williams' Orchid Album.

The abbreviations used in the descriptions of the plants are:—*Diam.*—Diameter. *Fl.*—Flower. *Fr.*—Fruit. *Ft.*—Foot or Feet. *G.*—Greenhouse. *H.*—Hardy. *H. H.*—Half-hardy. *In.*—Inches. *Infl.*—Inflorescence. *L.*—Leaves. *Lin.*—Line (one-twelfth of an inch). *Per.*—Perennial. *Pet.*—Petals. *S.*—Stove. *Sep.*—Sepals. *Shr.*—Shrub.

N.B.—Unless specified, all Orchids and Bromeliads may be considered to be stove epiphytes.

Abies excelsa, var. **mutabilis,** Veitch. (*W. G.* 1888, p. 107.) Coniferæ. Garden variety of **Picea excelsa.**

Abutilon chrysostephanum, var. **compactum.** (*W. G.* 1888, p. 123.) Malvaceæ. Garden variety.

Acæna adscendens, Vahl. (*B. T. O.* 1888, p. 331.) Rosaceæ. H. rock-work plant, with long creeping stems, giving off ascending branches. L. pinnate, leaflets ¼ to 1 in. long, obovate or elliptic-obovate, obtuse, toothed, glabrous above, silky beneath. Fl. heads globose, dark purple, on long peduncles. Patagonia.

Acæna ovina, A. Cunn. (*B. T. O.* 1888, p. 332.) H. similar to *A. ovalifolia*, R. and P., but a little larger and less graceful. The leaflets of the rather long pinnate l. are elliptic, obtuse, and pinnately cut to the middle, more or less pubescent on both sides, or glabrous above. Fl. in long interrupted spikes, purple. Australia.

Acæna sarmentosa, Carm. (*B. T. O.* 1888, p. 332.) H. per. A rampant species similar to *A. sanguisorbæ*, but stouter, with longer branches, and the leaves more silky beneath, and with longer hairs. Fl. in globose heads on tomentose peduncles of moderate length with one or two bracts. Tristan d'Acunha. [Perhaps the plant in cultivation is not correctly named, as it is said to come from South America. The above brief description is taken from dried specimens.—*N. E. B.*]

Acæna sericea, Jacq. (*B. T. O.* 1888, p. 332.) H. per. with rather long l., having but 3 to 5 pairs of cuneate, oblong, toothed leaflets, silky beneath. Fl. green in globose heads, on long peduncles, which also bear 2 or 3 smaller heads, sessile in the axils of leafy bracts. Patagonia, Chili. [*A. cuneata*, H. and A., is a synonym of this.—*N. E. B.*]

Acæna splendens, Hook. (*B. T. O.* 1888, p. 332.) H. alpine per. A stout tufted sp. L. pinnate, with 3–4 pairs of obovate or oblanceolate, toothed leaflets, densely silky white on both sides. Fl. in long interrupted spikes on long stout peduncles. Chili.

Acalypha triumphans, Lind. and Rod. (*Ill. H.* v. 35, p. 55, pl. 55; *L'Hort. Int. Cat.* 1888–9, p. 41; *H. G.* 1888, p. 502; and *W. G.* 1888, p. 384.) Euphorbiaceæ. S. shr. A good foliage plant, with large cordate, toothed, acute l., variegated with deep crimson, green, and brown. Solomon Isles. Seems to be a variety of **A. Wilkesiana.**

Acanthopanax spinosum, Miq. (*G. and F.* 1888, v. 1, p. 248.) Araliaceæ. H. shr. The accepted name for *Aralia pentaphylla*.

Acer platanoides, L. vars. **columnare, dilaceratum, euklorum, integrifolium, nanum** (syn. *pygmæum* of gardens), and **quadricolor,** of gardens. *H. G.* 1888, pp. 337–40.) Sapindaceæ. Garden varieties.

Adiantum colpodes, var. **roseum.** (*G. and F.* 1888, v. 1, p. 376.) Filices.

S. fern. A variety having the young fronds of a coppery-red hue.

Adiantum cuneatum, var. **Gordoni.** (*W. G.* 1888, p. 107.) Garden variety.

Adiantum reginæ. (*Veitch Cat.* 1888; *W. G.* 1888, p. 107.) A beautiful maiden-hair fern, approaching *A. Victoriæ* and *A. rhodophyllum*, with the habit of *A. scutum*.

Adiantum schizophyllum, Moore. *L'Hort. Int. Cat.* 1888–9, p. 45.) Garden variety of **A. æmulum.**

Adiantum versaillense. (*G. and F.* 1888, v. 1, p. 376.) A crested form of **A. capillus-veneris.**

Aechmea Drakeana, André. (*R. H.* 1888, p. 401; *Gfl.* 1888, p. 650; and *W. G.* 1888, p. 432,) Bromeliaceæ. A handsome plant, with a rosette of about 12, spreading-recurved l., 1½ ft. or more long, 2–2½ in. broad, channelled down the face; apex obtuse, mucronate; margins with short, straight, distant spines, green, tinted with violet beneath; both sides finely lepidote. Fl.-stem 1½ ft. high, violaceous at the base, red above, and covered with a white tomentum, and furnished with pale, narrow bracts. Spike oblong, lax. Fl. sessile; calyx glabrous, bright rose; corolla 1½ in. long, bright blue. Ecuador.

Aeranthus. *See also* **Angræcum.**

Aeranthus Grandidierianus, Rchb. (*O.* 1888, p. 200; and *H. G.* 1888, p. 127.) Orchideæ. [A synonym of Angræcum Grandidierianum, Carr.—*N. E. B.*]

Aeranthus ophioplectron, Rchb. f. (*G. C.* 1888, v. 4, p. 91; and *H. G.* 1888, p. 398.) *See* **Angræcum ophioplectron,** Rchb. f.

Aeranthus trichoplectron, Rchb. f. (*G. C.* 1888, v. 3, p. 264; *H. G.* 1888, p. 226; and *O.* 1888, p. 161.) L. soft, linear, contracted at the bidentate; apex, 5 in. long, ⅓ in. broad. Fl. solitary, axillary, white, including the filiform spur, nearly 5 in. long. Sep. lanceolate, acute. Pet linear-acuminate. Lip broad, concave at base, acuminate at apex. Madagascar.

Aerides falcatum, var. **compactum.** Rchb. f. (*G. C.* 1888, v. 3, p. 744; and *H. G.* 1888, p. 370.) Orchideæ. A compact form, with very thick stems, short broad l., and short infl.

Aerides Picotianum. (*G. C.* 1888, v. 4, p. 378.) At the place quoted this plant is stated by Prof. Reichenbach to be the same as **A. Houlletianum,** Rchb. f.

Æsculus turbinata, Blume. (*R. H.* 1888, p. 496, p. 120–124; and *G. and F.* 1888, v. 1, p. 491.) Sapindaceæ. H. tree, resembling ***Æ. hippocastanum*** in general appearance, but distinguishable at sight by the l. being pale greyish beneath. Fl. white. Fr. globose-turbinate, without spines. Seeds about 2 in each fr., with a very large hilum. Japan. Cultivated under the name of *Æ. chinensis*.

Agave Baxteri, Baker. (*G C.* 1888, v. 3, p. 392; and *H. G.* 1888, p. 229.) Amaryllidaceæ. G. succulent. L. about 30 in a dense sessile rosette, about 12 in. long, 3 in. broad, glaucous; spines ⅙–⅛ in. long, brown, hooked. Fl.-stem 8–10 ft. high; panicle lax, the branches 3–4 in. long, with a dense cluster of yellowish fl. Mexico?

Aglaonema picta, var. **compacta,** Bull. (*Bull. Cat.* 1888, p. 7; *L'Hort. Int. Cat.* 1888–9, p. 46.) Araceæ. S. foliage plant of dwarf compact habit, with obliquely oblong-ovate, acuminate, dark green l. sparingly blotched with grey. Spathes pointed, shining green. Java.

Albuca Allenæ, Baker. (*G. C.* 1888, v. 3, p. 10; and *H. G.* 1888, p. 125.) Liliaceæ. S. bulb, allied to *A. Wakefieldii*. Bulb globose, 2 in. or more in diam. L. about 6, lanceolate, flaccid, glabrous, 1–1½ ft. long, 1½–2 in. broad. Fl.-stem, 3–4 ft. high. Raceme lax. Fl. about ¾ in. long, greenish-white, inner segments not convenient. Stamens sharply constricted above a quadrate base. Ovary trigonous; style subulate, stigma capitate. Zanzibar.

Allamanda magnifica, Williams. (*Williams' Cat.* 1888, p. 19.) Apocynaceæ. S., a fine free flowering climber, with clusters of clear yellow fl., with a deep orange-yellow throat, about 5 in. in diam. A variety of *A. Schottii*.

Allium parciflorum, Viv. (*G. C.* 1888, v. 4, p. 236.) Liliaceæ. H., a small species, with an ovoid bulb, producing 1–3 slender stems, 4–10 in. high, bearing 2–4 slender filiform l., which are placed at from ⅓–½ way up the stem, and an umbel of 3–6 small purple fl. Corsica, Sardinia.

Alnus rhombifolia, Nutt. (*H. G.* 1888, p. 558.) H., an ornamental tree similar to *A. rubra*, but branches more slender, the dark brown bark scarcely dotted with white, and the nutlets with a thickened margin, not winged as in *A. rubra*. L. ovate or ovate-oblong, obtuse or acute, cuneate at the base, irregularly glandularly toothed, smooth above, slightly pubescent beneath, 2–3 in. long. California.

Alocasia Chantrieriana, Rodigas. (*Ill. H.* 1888, v. 35, p. 79, pl. 64.) Araceæ. Garden hybrid.

Alocasia gigas, Linden. (*L'Hort. Int. Cat.* 1889–9, p. 41.) S. per. No description or locality given.

Alocasia princeps, *Bull.* (*Bull. Cat.* 1888, p. 7; *L'Hort. Int. Cat.* 1888–9, p. 46.) S., an ornamental foliage plant. Petioles slender, greyish-green, marbled with chocolate-brown. Blade sagittate, the hind lobes narrow and spreading, with a triangular sinus, margins deeply sinuate. Upper surface metallic olive-green, darker along the midrib and veins; under surface greyish-green, with prominent, rounded, chocolate-brown veins. Malay Archipelago.

Aloe Hildebrandtii, Baker. (*B. M.* t. 6981; *G. C.* 1888, v. 3, p. 242; *H. G.* 1888, p. 181; and *R. H.* 1888, p. 479.) Liliaceæ. G. succulent. A distinct plant, with an erect, laxly, leafy stem; lanceolate-attenuate l. 6–10 in. long, $1\frac{1}{2}$–2 in. broad, of a glaucous green marked with a few white spots, and spiny on the margins; and large branching panicles of tubular fl. an inch long, laxly disposed. Outer perianth segments coral red, inner yellowish, with green keels. E. Trop. Africa.

Aloe longiflora, Baker. (*G. C.* 1888, v. 4, p. 756.) G. succulent. A large aloe, with a simple stem, bearing a lax rosette of tapering l., 15–18 in. long, $1\frac{1}{2}$ in. broad, glossy green, armed with numerous green prickles on the margin. Raceme simple, dense, 6–8 in. long. Bracts ovate, scarious, $\frac{1}{4}$ in. long. Pedicels about as long as the bracts. Fl. cylindrical, $1\frac{1}{2}$ in. long, pale yellow, tipped with green. Stamens, $\frac{1}{2}$ in. longer than the fl., with small red anthers.

Aloe penduliflora, Baker. (*G. C.* 1888, v. 4. p. 178; and *H. G.* 1888, p. 458.) G. succulent. A distinct plant, remarkable for the way in which the pendulous scape appears to arise from the base of the back of the lax, attenuate pale green l., which are flattish above, and have small marginal prickles. Raceme dense, turned up at the end of the pendulous scape. Fl. pale yellow. Zanzibar.

Alpinia officinarum, Hance. (*B. M.* t. 6995; *G. C.* 1888, v. 3, p. 592; *G. and F.* 1888, v. 1, p. 227; and *H. G.* 1888, pp. 311 and 328.) Scitamineæ. S. per. Rhizome stout, creeping, swollen at intervals. L. narrow lanceolate-acuminate. Scape terminal, erect, pubescent. Fl. sessile, white, veined on the lip with purple. Calyx campanulate, 2-lipped. Corolla-lobes linear-oblong obtuse, $\frac{3}{4}$ in. long. Lip elliptic-oblong obtuse, a little longer than the corolla. South China.

Amaranthus Margaritæ, Dam. (*W. G.* 1887, p. 433-4, f. 71.) Amaranthaceæ. N. annual. Garden variety.

Amaryllis Tettaui. (*Gfl.* 1888, p. 625.) Amaryllidaceæ. S. bulb. Garden variety.

Amelanchier alnifolia, Nutt. (*G. and F.* 1888, v. 1, p. 185, f. 34, and p. 202.) Rosaceæ. H. An ornamental shr., 6–8 ft. high, with broad elliptic-oblong l., very obtuse, and toothed at the apex; slightly cordate at base. Racemes short, fl. large. Fl. globose, $\frac{1}{4}$ in. in diam., dark purple. N. W. America.

Amelanchier oligocarpa, Roem. (*G. and F.* 1888, v. 1, pp. 245 and 247, f. 41.) H. A low bushy shr. 2–4 ft. high, with oblong, acute, crenulate, glabrous l., and white fl. $\frac{3}{4}$ in. in diam., on long pedicels, solitary or in pairs, rarely 3–4 in a raceme. Fl. dark blue-purple, obovate or shortly oblong. Eastern United States.

Anabasis ammodendron, C. A. Mey. (*W. G.* 1888, p. 37.) Chenopodiaceæ. H. shr., with leafless woody stems and an abundance of small yellow fl. Central Asia.

Angræcum. *See also* **Aeranthus.**

Angræcum ophioplectron, Rchb. f. (*G. C.* 1888, v. 4, p. 91.) Orchideæ. Allied to *A. Curnowianum.* Sep. 1 in. long, $\frac{1}{6}$ in. broad, narrow acuminate, spreading; pet. narrower, curved down behind the side sep. Lip triangular, acuminate, with a filiform spur 4 times as long as itself, twisted near the base. Fl. greenish yellow, with a white lip and ochre-reddish spur. Syn. *Aeranthus ophioplectron,* Rchb. f. Madagascar.

Angræcum Sanderianum, Rchb. f. (*G. C.* 1888, v. 3, pp. 168, 395; *G. and F.* 1888, p. 16; *H. G.* 1888, p, 178; and *R. H.* 1888, p. 516, with pl.) Allied to *A dependens.* Stem ascending. L. cuneate-oblong, about 4 in. long and $1\frac{1}{4}$–$1\frac{3}{4}$ in. broad, the apex unequally lobed. Pedicel with short tumid base not longer than the bract. Sep. triangular. Pet. and lip elliptic, apiculate. Spur slender, 3 times as long as the ovary ascending. Fl. white, $\frac{3}{4}$ in. in diam. Comoro Isles.

Angræcum tridactylites, Rolfe. (*G. C.* 1888, v. 4, p. 34; and *H. G.* 1888, p. 397.) Allied to *A. bicaudatum.* Bulbs sub-compressed, with sub-acute angles $\frac{1}{4}$ in. broad. L. linear, 3–5 in. long, 5–8 lin. broad, unequally bidentate Racemes lateral, about 2 in. long

Fl. distichous, $\frac{1}{3}$ in. in diam., buff-coloured. Sep. and pet. ovate acute. Lip 3-lobed, with 2 fleshy marginal teeth at the base, the lateral lobes bristle-shaped, recurving. Sierra Leone.

Anguloa intermedia, Rolfe. (*G. C.* 1888, v. 3, p. 798; *H. G.* 1888, p. 396; and *L.* v. 4, p. 8.) Orchideæ. Garden hybrid.

Anguloa Ruckeri, var. **alba.** (*G. and F.* 1888, v. 1, p. 315.) A white-flowered variety.

Anhalonium Lewinii, Henn. (*Gfl.* 1888, p. 410–11, f. 92; and *H. G.* 1888, p. 461.) Cactaceæ. G. succulent. A small and very dwarf species about 2 in. in diam. The central part convex, and densely white-villous; the outer tubercles, in about 12 series, broadly polyhedric, glabrous, with a woolly tuft at their apex. Fl. small, pale rose, arising among the central tubercles; sep. in two series, acute; pet. about as long as the sep., very obtuse. Mexico. Not at present in cultivation.

Anoiganthus breviflorus, Baker. (*G. C.* 1888, v. 4, p. 411, misprinted Anigosanthus.) Amaryllidaceæ. G. bulb, with strap-shaped l., 1 ft. long by $\frac{3}{4}$ in. broad, and a scape about 9 in. long, bearing an umbel of several tubular, bright yellow fl., about an in. in diam. This is cultivated in some gardens under the erroneous name of *Cyrtanthus lutescens.* Natal.

Anoplophytum strictum, var. **Krameri,** André. (*R. H.* 1888, p. 350.) Bromeliaceæ. This is a species of *Tillandsia* resembling *T. stricta,* but the l. are longer, much more slender, and perhaps rather more scurfy. The bracts are deep rose, the calyx rosy-white, and the corolla white in the lower half, and clear violet in the upper half. Brazil. [Mr. Baker intends describing this in his handbook of Bromeliaceæ as a **Tillandsia**—*N. E. B.*]

Anthurium Chamberlaini, Masters. (*G. C.* 1888, v. 3, p. 462 and 464–5, f. 66, 67; *B. T. O.* 1888, p. 284; *G. and F.* 1888, v. 1, p. 168; *H. G.* 1888, p. 280; *Ill. H.* v. 35, p. 73, pl. 62; *R. H.* 1888, p. 194; and *W. G.* 1888, p. 201.) Araceæ. S. A large bold looking species, with large cordate l. 3 ft. long by 2 ft. broad, on petioles 3½–4 ft. long. Scape a ft. or more long. Spathe boat-shaped, erect, 8–9 in. long, 4 in. broad, pale dull puce coloured outside, shining crimson inside. Spadix 6 in. long, ¾ in. thick, on a stalk about $\frac{1}{2}$ in. long, dull reddish purple. Venezuela?

Anthurium Desmetianum, Rodigas. (*Ill. H.* v. 35, p. 47, pl. 52; *G. C.* 1888, v. 4, p. 302; *H. G.* 1888, p. 400; and *W. G.* 1888, p. 383.) Garden hybrid.

Anthurium isarense, André. (*R. H.* 1888, p. 423.) Garden hybrid.

Anthurium Kellermanni, of gardens. (*H. G.* 1888, p. 49.) Garden hybrid.

Anthurium Laingi. (*W. G.* 1888, p. 383.) Garden variety.

Anthurium Lawrenceanum, André. (*R. H.* 1888, p. 12, with pl.) Garden hybrid.

Anthurium longispathum, Carr. (*R. H.* 1888, p. 498; and *W. G.* 1888, p. 467.) S. An acaulescent species of vigorous growth. L. on long petioles, the bade 2 ft. long by 18 in. broad, thick and coriaceous, deeply cordate at the base, pale green, the veins very prominent beneath. Peduncle terete, grooved, stout, 3 ft. long. Spathe 15 in. long. Spadix very stout, cylindric, 2 ft. long. Guadeloupe.

Anthurium roseum. (*B. T. O.* 1888, p. 99.) Garden hybrid.

Anthurium Scherzerianum, var. **albolineatum.** (*W. G.* 1888, p. 278.) Garden variety.

—— Var. **nebulosum,** *Devansaye.* (*R. H.* 1888, p. 146.) Garden variety, with double white spathes dusted with red.

—— Var. **Waroqueanum, Rodigas.** (*Ill. H.* v. 35, p. 43, pl. 51; and *H. G.* 1888, p. 400.) This variety has white spaths spotted with red, and yellow spadices. [It does not appear to be distinct from the variety **Rothschildianum.** N. E Brown.]

Antigonon leptopus, var. **albiflora,** Damm. (*W. G.* 1888, p. 472.) Polygonaceæ. S. climber. A white-flowered variety.

Antirrhinum Nuttallianum, Bth. (*Gfl.* 1888, p. 331, t. 1275, f. 3; *G. C.* 1888, v. 3, p. 806; and *H. G.* 1888, p. 371.) Scrophulariaceæ. H. H. A rather slender branching plant 1–2 ft. high, softly pubescent and viscid. L. ovate, the lower about an in. long, the upper smaller and nearly sessile. Fl. axillary pedicillate, purple, the tube of the corolla not longer than the spreading lips. California.

Aphelandra amoena, Bull. (*Bull Cat.* 1888, p. 7; *L'Hort. Int. Cat.* 1888–9, p. 47.) Acanthaceæ. S. shr. A pretty foliage plant, with ovate acuminate l., of a deep green, variegated with silvery grey along the course of the midrib and veins. Brazil.

Aquilegia flabellata, var. **nana flore albo.** (*B. T. O.* 1888, p. 118, f. 17.) Ranunculaceæ. Garden variety.

Aquilegia longissima, A. Gray. (*G. and F.* 1888, v. 1, p. 31, f. 6, and p. 90.) H. per. A handsome columbine of tall habit, allied to *A. chrysantha*; slightly pubescent, with silky hairs. L. glaucous beneath. Fl. pale yellow, or straw colour, or nearly white, or tinged with red; spurs 4 in. or more long. Texas and Mexico.

Aquilegia Stuarti, André. (*R. H.* 1888, p. 539; and *H. G.* 1888, p. 552.) Garden hybrid.

Aralia cachemirica, Dcne. **(cashimerica).** (*G. and F.* 1888, v. 1, p. 320; and *W. G.* 1888, p. 436.) Araliaceæ. H. A noble and stately herbaceous per., growing 6 ft. high, with very large compound l., the leaflets being 4–5 in. long, acuminate, hispidulous and serrate; the umbels of white fl. are disposed in a narrow terminal raceme 3–4 ft. long. Cashmere. [This is the same as **A. macrophylla,** Lindl., both names were published in 1844.—*N. E. B.*]

Arauja graveolens, Mast. (*G. C.* 1888, v. 4, p. 271, f. 33.) Asclepiadeæ, This is the plant known as *Schubertia grandiflora*, and S. *graveolens* or *Physianthus graveolens*, now referred to the genus *Araujа*.

Aristolochia Westlandi, Hemsley. (*B. M.* t. 7011; *G. C.* 1888, v. 3, p. 332, and v. 4, p. 186; and *H. G.* 1888, p. 459.) Aristolochiaceæ. S. Climber, very similar to *A. longifolia*, but with much larger fl. L. 6–10 in. long, narrow oblong-lanceolate, acuminate, cordate at base, glabrous above, pubescent beneath. Fl. pendent, peduncle 3–5 in. long, hairy, with brown hairs. Perianth tube bent on itself, limb roundish-ovate, about 6 in. long by 5 in. broad, greenish-yellow, reticulately veined with purple-brown. China.

Armeria undulata, Boiss. (*W. G.* 1888, p. 325.) Plumbagineæ. H. per. Something like the common Thrift, but the outer l. are linear-lanceolate and wavy on the edges, the inner l. being linear and entire. The fl. and bracts are white. Greece.

Arnebia cornuta, F. and M. (*G. and F.* 1888, v. 1, p. 6.) Boragineæ. H. A pretty annual, growing to $1\frac{1}{2}$ ft. high, and 2 ft. in diam., with lanceolate, dark green, hairy, l., and racemes of deep yellow fl., with 5 black spots at the base of the lobes, which change to brown and finally disappear. Afghanistan.

Asarum macranthum, Hook. f. (*B. M.* f. 7022; *G. C.* 1888, v. 4, p. 416; and *H. G.* 1888, p. 553.) Aristolochiaceæ. G. per. of dwarf habit. L. all radical; petioles 5–6 in. long; blade 3–4 in. long, and nearly as broad, cordate-ovate acute, green, clouded with yellowish-green, pale beneath, with purplish venation. Fl. numerous, densely crowded at the base of the l., $2-2\frac{1}{2}$ in. in diam., brownish, with 3 large wavy lobes and a raised border around the mouth of the pear-shaped tube. The fl. are strongly scented like Fenugreek. Formosa.

Asclepias atrosanguinea aurea. (*G. and F.* 1881, v. 1, p. 356.) Asclepiadaceæ. G. or H. H. An ornamental plant, which seems to be a variety of *A. curassavica*, with deep blood-red fl. having a yellow corona. Bolivia.

Asparagus comorensis. (*W. G.* 1888, p. 158.) Liliaceæ. S. per. of vigorous climing habit, very useful for boquets, &c., surpassing the finest-cut ferns, with slender, emerald green foliage, somewhat like that of *A. plumosus*. Perhaps the same as *A. decumbens*.

Aspasia principissa, Rchb. f. (*G. C.* 1888, v. 3, p. 424; and *H. G.* 1888, p. 279.) Orchideæ. An interesting Orchid, with fl. like those of an *Odontoglossum*, 2 in. or more in expanse; sep. and pet. linear lanceolate, light green, with brown lines; lips broadly pandurate, with two parallel tubercles at the base, light buff.

Asphodelus Villarsi, Verlot. (*W. G.* 1888, p. 272.) H. per., resembling *A. ramosus*, but with rather larger fl., considered to be more showy. Europe.

Aspidium cristatum, var. **Clintonianum.** (*G. and F.* 1888, p. 342.) H. A strong-growing variety.

Aster alpinus, var. **speciosus,** Regel. (*Gfl.* 1888, p. 355, t. 1276, f. 1; and *H. G.* 1888, p. 401.) Compositæ. H. A robust variety, about $1\frac{1}{2}$ ft. high, with very showy fl. 3 in. in diam., ray purple, disk yellow.

Aubrietia. Leichtlini. (*W. G.* 1888. p. 325 and see Gfl. 1886, p. 349.) Cruciferæ. H. per. A form with deep red fl.

Azaleastrum albiflorum. (*W. G.* 1888, p. 435.) Ericaceæ. A synonym of **Rhododendron albiflorum,** Hook.

Bahia confertiflora, D. C. (*Gfl.* 1888, p. 329, t. 1275, f. 1; *G. C.* 1888, v. 3, p. 806; and *H. G.* 1888, p. 371.) Compositæ. H. herbaceous per. of ornamental character, 12–18 in. high, more or less woolly. L. small, cuneate, pinnately 5-7 lobed, lobes linear. Stems naked at the summit, terminated by small dense corymbose cymes, of yellow, radiate flower-heads. California.

Bambusa Veitchii, Carriere. (*R. H.* 1888, p. 90; *G. C.* 1888, v. 3, p. 332; and *W. G.* 1888, p. 161.) Gramineæ. H. A very ornamental dwarf Bamboo, with terete stems, and oblong acuminate l., 4–8 in. long, 1¼–2¼ in. broad, bright green above, bluish-green beneath, changing in autumn to yellow, or with a broad yellow border. Syn. *B. palmata.* Latour-Marliac. Japan. [This plant is **Bambusa tessellata,** Munro, and is also the same as *Arundinaria kurilensis* var. *paniculata*. Rupr. The infl. is a narrow panicle, on stems 1½–2 ft. long, or perhaps more, which bear sheaths but no l. The spikes are composed of 5–6, close set, 1-flowered spikelets, on the moderately short branches (2–2½ in. long) of the panicle. *N. E. B.*]

Begonia Bismarcki. (*Veitch Cat.* 1888, p. 10.) Begoniaceæ. Garden variety.

Begonia Clementinæ, Bruant. (*Ill. H.* v. 35, p. 11, pl. 39; and *H. G.* 1888, p. 232.) Garden hybrid.

Begonia Haageana. (*G. C.* 1888, v. 4, p. 49.) This is a garden name for **B. Scharffi.**

Begonia globosa, Heinemann. (*Gfl.* 1888, p. 645, f. 143.) Garden hybrid.

Begonia Lesoudsii, André. (*R. H.* 1888, p. 20, f. 5; *H. G.* 1888, p. 123; and *W. G.* 1888, p. 72.) Garden hybrid.

Begonia Scharffiana, Regel. (*Gfl.* 1888, p. 127, and p. 661, f. 146.) Also published as

Begonia Scharffi, Hook. f. (*B. M.* t. 7028; and *G. C.* 1888, v. 4, p. 670 and 695.) S. A handsome free-flowering species, 1½–2 ft. high, hispid with red hairs. L. 4–10 in. long, 2–5 in. broad, obliquely, cordate-ovate acuminate, purplish beneath. Fl. white, in large, long-stalked corymbs. Male fl. 2–2½ in. in diam., with two large elliptic seps. echinate with red bristles outside, and 2 narrow spathulate pet. Female fl. smaller, with equal obovate segments; ovary 3-winged, echinate, with red bristles. Syn. *B. Haageana*, of gardens. South Brazil.

Berberis aristata, var. **integrifolia,** (*W. G.* 1888, p. 108.) Berberidaceæ. H. shr. A variety without spines on the edge of the l.

Berberis Fendleri, Gray. (*G. and F.* 1888, v. 1, p. 460, and p. 462, f. 72.) H. Barbery, in the way of *B. vulgaris.* Stem and branches purplish, shining. Fl. in racemes 1–2 in. long, yellow, with some red bracts at the base of the calyx. Rocky Mountains.

Berberis Fremonti, Torr. (*G. and F.* 1888, v. 1, p. 496, f. 77.) H. evergreen shr. One of the *Mahonia* section. L. pinnate, leaflets in 2–3 pairs, oblong-lanceolate, with 2–3, large, spine-tipped teeth on each side. Racemes ascending, laxly few-flowered. Fr. dry and inflated when ripe. Texas, Arizona.

Berchemia racemosa, S. and Z. (*W. G.* 1888, p. 287.) Rhamnaceæ. H. climbing shr. with oblong, or oblong-ovate, subacute l., and terminal panicles of small fl., succeeded by dark brown berries. Japan, China.

Betula papyracea, var. **occidentalis,** Lyall. (*H. G.* 1888, p. 558.) Cupuliferæ. H. shr., said to differ from the typical form by its deciduous bark, and larger and thicker l., which are shining above. It comes true from seed. N. W. America.

Billbergia Krameriana, Wittm. (*Gfl.* 1888, p. 657.) Bromeliaceæ. Garden hybrid.

Biota orientalis, var. **laxenburgensis,** (*W. G.* 1888, p. 475.) Coniferæ. Garden variety.

Bollea hemixantha, Rchb. f. (*G. C.* 1888, v. 4, p. 206; and *H. G.* 1888, p. 458.) *See* **Zygopetalum hemixanthum,** Rchb. f

Bollea Wendlandiana. (*G. and F.* 1888, v. 1, p. 315.) *See* **Zygopetalum Wendlandi.**

Bouvardia luteola plena. (*W. G.* 1888, p. 157.) Rubiaceæ. Garden variety.

Brassia Keiliana, var. **tristis,** Rchb. f. (*W. O. A.* v. 8, pl. 347; and *G. C.* 1888, v. 4, p. 411.) Orchideæ. A variety with deep amber-brown sep. and pet., and a lemon-yellow lip with a semicircular series of brown spots at the base. Venezuela and Columbia.

Brocchinia cordylinoides, Baker. (*G. C.* 1888, v. 4, p. 474.) Bromeliaceæ. A large terrestrial Bromeliad with a trunk growing to 15 ft. in height, L. in a dense terminal rosette, 3–4 ft. long, 6–8 in. broad, green, and obscurely scurfy on both sides, margins without prickles. Infl. a large panicle, 6–8 ft. long, bearing innumerable, small, yellowish fl. British Guiana.

Brodiæa Bridgesii, S. Wats. (*G. and F.* 1888, v. 1, p. 125, f. 24.) Liliaceæ

A pretty G. bulb, with linear l., and an umbel of 10–20 funnel-shaped blue fl., 1–1¼ in. long. California.

Brodiæa Howellii, S. Wats. (*B. M.*, t. 6989; *G. C*, 1888, v. 3, p. 466; *H. G.* 1888, p. 282; and *R. H.* 1888, p. 480.) H. H. bulb, with two, linear, channelled, bright green l., 10–12 in. long., and an umbel of 4–8 campanulate, white, or pale lilac fl., about ¾ in. in diam. Western United States.

Bulbophyllum Dearei, Veitch, *Veitch. Man. Dendrob.*, p. 95.) Orchideæ. This is *Sarcopodium Dearei*, now referred to **Bulbophyllum.**

Bulbophyllum oxyodon, Rchb. f. See **Megaclinium oxyodon,** Rchb. f.

Cæsalpinia japonica, S. and Z. (*G. C.* 1888, v. 4, p. 513, f. 73.) Leguminosæ. H. shr. of ornamental character, producing long shoots armed with hooked prickles, and bipinnate l., which are also prickly along the main petiode, the leaflets are oblong obtuse. Fl. it terminal racemes, bright yellow, about ¾ in. in diam. Japan.

Calandrinia oppositifolia, S. Wats. (*G. C.* 1888, 4, p. 601, f. 83.) Portulaceæ. H. per. herb, with tuberous rootstock; oblanceolate, fleshy l., 2–3 in. long., and a fl. stem 3–10 in. high, bearing a few handsome fl. over an in. in diam., either white, or blush-rose coloured; the pet. are 9–11 in number, and toothed at the apex. Oregon.

Calanthe Halli. (*W. G.* 1888, p. 108.) Orchideæ. Garden hybrid.

Calanthe striata, R. Br. (*B. M.* t. 7026; *G. C.* 1888, v. 3, p. 364, and v. 4, p. 578.) G. This is cultivated as *C. Sieboldii* The plicate l. are broadly lanceolate, acute, 6–10 in. long. Fl. stem 18 in. high; raceme lax. Fl. 1½ in. in diam. Sep. and pet. oblong acute, yellow outside, brownish inside. Lip, light yellow, deeply 3-lobed, the middle lobe being again shortly 2-lobed, and having 3 ridges which are raised into tubercles at their apex and near their base. Japan.

Calceolaria arachnoideo-crenatiflora. (*H. G.* 1888, p. 401.) Scrophulariaceæ. Garden hybrid.

Camassia Cusickii, S. Wats. (*G. and F.* 1888, v. 1, p. 172 and 174, f. 32.) Liliaceæ. H. A showy species with large clustered bulbs; glaucous, slightly wavy l., 1½–2 ft. long, 1½ in. broad, and a leafy fl. stem 2–3 ft. high, bearing a long, moderately dense raceme of very pale blue fl. 1½ in. in diam., with narrow oblanceolate obtuse segments. Oregon.

Campanula glomerata, var. **dahurica** (*W. G.* 1888, p. 283, f. 55.) Campanulaceæ. H. per. Seems to be only a dwarf, floriferous form.

Cassebeera triphylla, Kaulf. (*G. C.* 1888, v. 4, p. 501.) Filices, G. A compact little fern, about 4 in. high, with black-stalked trifoliolate fronds, the leaflets about 1½ in. long, and scarcely ¼ in. broad, crenulate, dark shining green. Sori in close rows along the margins. Brazil.

Cassia coquimbensis, Vogel. (*B. M.* t. 7002; *G. C.* 1888, v. 3, p. 722; *G. and F.* 1888, v. 1, p. 275; and *H. G.* 1888, p. 369.) Lequminosæ. S. A handsome shr. with pinnate l. and terminal corymbose racemes of bright yellow fl. 1–1½ in. in diam. L. 2–4 in. long; leaflets in 4–6 pairs, elliptic-oblong, mucronate. Upper pet. obcordate rather larger than the rest, which are obovate. Pods stipitate, 3–4 in. long, ½ in. broad, flattened. Chili.

Catalpa umbraculifera. (*B. T. O.* 1888, p. 330.) Bignoniaceæ. H. A handsome shr. or small tree 9–12 ft. high, with a rounded, compact head. No further description. China. Perhaps a garden variety.

Catasetum Bungerothi, var. **album.** Linden. (*L.* v. 4, p. 8.) Orchideæ. A variety with large pure white fl., with a delicate rose-coloured spot on the lip.

Catasetum decipiens, Rchb. f. (*L.* v. 3, p. 99, pl. 144.) A distinct looking plant with stout fusiform bulbs 3–4 in. long; lanceolate acute l., and a lax raceme of fl. about 1½ in. in diam. Sep. and pet. lanceolate acute, reddish-brown with darker-spots. Lip with a hemispherical sac, and a revolute margin, yellow outside, reddish-brown inside. Venezuela.

Catasetum Garnettianum, Rolfe. (*G. C.* 1888, v. 4, p. 692.) Allied to *C. barbatum*, but smaller. Bulbs 1 2 in. long, compressed-ovate or conical. L. lanceolate, 4 in. long, ½ ¾ in. broad. Scape erect, as long as the l., several flowered. Fl. about 1¾ in. in diam. Sep. and pet. lanceolate-linear 10 lin. long, acute, light green, thickly spotted with chocolate-brown. Lip white, ¾ in. long, linear, divided into bristles at the apex, and with shorter bristles on the margins below the middle.

Catasetum pulchrum, N. E. Br. (*G. C.* 1888, v. 3, p. 10 and p. 235; *L.* v. 3, p. 51, pl. 120, and *O.* 1888, p. 260.) A pretty species with stout fusiform bulbs 4–6 in. long, ¾–1 in. thick, from the base of which spring short racemes of 5 or 6 fl. Sep. and pet. elliptic acute, light green with chocolate bars. Lip oblong-saccate, obscurely 3-toothed at apex, deep yellow. Brazil.

Catasetum quornus. (*H. G.* 1888, p. 285.) A misprint for **C. gnomus,** Rchb. f.

Catasetum tapiriceps, Rchb. f. (*G. C.* 1888, v. 3, p. 136; *H. G.* 1888, p. 176; *L.* v. 3. p. 58; and *O.* 1888, p. 211.) Something in the way of *C. macroglossum.* Sep. green. Pet. brown. Lip orange, trigonous-saccate, with a free toothletted margin, the side lobes revolute, and the mid lobe with a transverse emarginate keel not far from the margin. Brazil.

Catasetum trulla, Ldl. var. **maculatissimum,** Rchb. f. (*G. C.* 1888, v. 3, p. 168; *H. G.* 1888, p. 178.) A variety having the pet. and lip spotted with brown, and the side lobes of the lip fringed.

Cattleya, aurea var. **marmorata,** O'Brien. (*G. C.* 1888, v. 4, p. 326.) Orchideæ. A grand variety with the yellow sep. and pet. marbled with dark rose. Lip violet-crimson in front, yellow, veined with purple on the basal half.

Cattleya bicolor, var. **Measuresiana,** Warn. and Will. (*W. O. A.* pl. 357.) A handsome variety, having the lip bordered with white. Brazil.

Cattleya Cassandra, Rolfe. (*G. C.* 1888, v. 4, p. 596.) Garden hybrid.

Cattleya citrino-intermedia, Rolfe. (*G. C.* 1888, v. 3, p. 73; *H. G.* 1888, p. 128; and *O.* 1888, p. 34.) Garden hybrid.

Cattleya flaveola, Rchb. f. (*G. C.* 1888, v. 4, p. 473; and *H. G.* 1888, p. 551.) Garden hybrid.

Cattleya Gaskelliana, var. **albens.** See **C. labiata Gaskelliana,** var. **albens.**

Cattleya Gibeziæ, Lind. and Rod. (*L.* v. 3, p. 77, pl. 133.) See **C. intermedia,** var. **Gibeziæ.**

Cattleya guatemalensis, var. **Wischhuseniana,** Rchb. f. (*G. C.* 1888, v. 4, p. 378; and *H. G.* 1888, p. 548.) A variety with light reddish-purple sep., rose-purple pet., and a brown lip with the disk yellow, and a white spot at the base. Panama.

Cattleya guttata, var. **munda,** Rchb. f. (*G. C.* 1888, v. 4, p. 378; and *H. G.* 1888, p. 549.) A variety with greenish, sep. without spots, changing to yellow.

Cattleya guttata Leopoldi, var. **odoratissima,** Rchb. f. (*G. C.* 1888, v. 4, p. 378; and *H. G.* 1888, p. 549.) A variety with Heliotrope-scented fl. Sep. and pet. yellow on both sides. Lip with purple front lobe and disk, and white side lobes.

Cattleya Harrisoniana, var. **Regnieriana,** Rchb. f. (*G. C.* 1888, v. 4, 264; and *H. G.* 1888, p. 503.) A variety with rather short sep. and pet. of a clear warm purple. Lip with the side lobes light purple outside, and light yellow inside, with a light purple border, the front lobe is very deeply plainted and minutely crenulate, and stands upright and hides the column, whitish yellow with an "orange callous basilar disc," purplish-tinted outside.

Cattleya intermedia, var. **Gibeziæ,** Lind. and Rod. (*L.* v. 3, p. 77, pl. 133; and *G. C.* 1883, v. 3, p. 806.) A variety with white fl., marked with 3-orange lines on the disk of the lip. Syn. *C. Giberziæ,* Lind. and Rod. Brazil.

Cattleya intermedia, var. **Parthenia,** Rchb. f. (*G. C.* 1888, v. 4, p. 178; and *H. G.* 1888, p. 458.) A form with elongated bulbs and white fl.

Cattleya Krameriana, Rich. f. (*G. C.* 1888, v. 4, p. 323; and *H. G.* 1888, p. 505.) Said to be a hybrid between *C. intermedia C. Forbesii,* raised in Brazil. Sep. and pet. rather narrow pale rose. Lip white, with two dark mauve-purple areas, and light purplish side lobes with rose-coloured borders; keels 5, rough, of a reddish hue.

Cattleya labiata Gaskelliana, var. **alba,** Rchb. f. (*G. C.* 1888, v. 4, p. 178; *H. G.* 1888, p. 458; and *W. O. A.* v. 8, pl. 353.) A white flowered variety with a yellow throat to the lip. Venezuela.

Cattleya labiata Gaskelliana, var. **albens,** Rchb. f, (*Gfl.* 1888, pp. 297, 545, t. 1274; *G. C.* 1888, v. 4. p. 122; and *H. G.* 1888, p. 371.) A variety with white fl. delicately tinted with lilac, and with a yellow disk to the lip, which is veined in the throat with orange-brown.

Cattleya labiata, var. **leucophœa.** (*W. G.* 1888, p. 109.) A shewy variety with delicate rosy-white sep and pet., the lip is lilac-shaded, striped with yellow in the throat, crisped on the margin.

Cattleya labiata, var. **magnifica,** Regel. (*Gfl.* 1888, p. 497, t. 1281, f. 1; and *H. G.* 1888, p. 501.) Fl. light rosy-purple, the front lobe of the lip dark purple, and the throat yellow.

Cattleya labiata Mossiæ, var. **Peetersii,** Rchb. f. (*G. C.* 1888, v. 4, p. 6; and *H. G.* 1888, p. 397.) This is the *C. Peetersii,* André, referred as a variety to *C. labiata.*

Cattleya labiata Percivaliana, var. **bella,** Rchb. f. (*G. C.* 1888, v. 3, p. 361; and *H. G.* 1888, p. 229.) A variety with bright purple fl. having the wavy sep., the pet., and front part of the lip, all spotted with dark purple.

Cattleya labiata Trianæi, var. **Ernesti,** Sander. (*R.* v. 1, p. 99, t. 43.) A variety with the sep. and pet. of a delicate blush tint, with the apex of the pet. blotched with purple. Lip purple with a darker purple disk, and the tube white with a large yellow blotch in front.

Cattleya labiata Warscewiczii rochellensis, Rchb. f., also named **C. rochellensis,** Rchb. f. (*G. C.* 1888, v. 4, p. 533.) A white variety, with a yellowish hue on the disk, and a faint purplish hue on the front part of the lip.

Cattleya Mossiæ, var. **variabilis,** Cherv. (*Jard.* 1888, p. 114, with fig.) An interesting form, in which the fl. are said to have been blue when they first opened, afterwards changing to mauve, and then to rose.

Cattleya velutina, var. **Lietzei,** Rgl. (*Gfl.* 1888, p. 49, t. 1265; and *G. C.* 1888, v. 3, p. 235.) A variety with narrow lanceolate acute sep., of a dusky orange, with a few purple dots; broader lanceolate, wavy pet., ochreous with purple dots; and a roundish-flabellate white lip, veined with purple. Brazil.

—— Var. **punctata,** Rgl. (*Gfl.* 1888, p. 51.) Fl. larger, the sep. and pet. thickly dotted with purple, and the front lobe of the lip margined with yellow. Brazil.

Cautleya lutea, Royle. (*B. M.* t. 6991; *R. H.* 1888, p. 480; and *G. C.* 1888, v. 3, p. 466, as *Cattleya lutea.*) Scitamineæ, S. per. This is the same as *Roscoea gracilis* Sm. and ***R. lutea,*** Royle, maintained as a distinct genus. N. W. Himalayes.

Ceanothus ovalis, Bigel. (*G. and F.* 1888, v. 1, p. 249.) Rhamanceæ. H. shr. 2–3 ft. high, of compact habit, with narrow, elliptic, obtuse or acute, crenulate l., and dense, corymbose umbels of white fl. Texas.

Cephaelis Bearii, Linden. (*H. G.* 1888, 571.) Rubiaceæ. S. shr. of no great beauty, with small inconspicuous umbels of fl. Mexico.

Chænactis tenuifolia, Nutt. (*Gfl.* 1888. p. 330, t. 1275, f. 2; *G. C.* 1888, v. 3, p. 806; and *H. G.* 1888, p. 371.) Compositæ. H. annual. A pretty herbaceous plant 9–15 in. high, leafy and branching. L. pinnately or bipinnately cut into narrow linear lobes. Heads corymbose, on short peduncles, yellow. California.

Chænomeles japonica, var. **Semirenkiana,** Semirenko. (*R. H.* 1888, p. 519.) Rosaceæ. H. shr. A garden sport of **Pyrus japonica,** with creamy l.

Chamæcyparis pisifera, var. **casuarinifolia.** (*W. G.* 1888, p. 477.) Coniferæ. Garden variety.

Chevalliera gigantea, P. Maury. (*Jard.* 1888, p. 8, with fig., and p. 71; and *R. H.* 1888, p. 370, f. 83.) Bromeliaceæ. A grand and very distinct species. L. 6½–9 ft. long, erect, slightly recurving at the acute apex, 2–3 in. broad, channelled down the face, glaucous green with black marginal spines. Fl. stem 18–20 in. long, stout, clothed with rose coloured bracts. Spike dense, about 4 in. thick. Fl. undescribed. Brazil.

Chionophila Jamesii, Benth. (*G. and F.* 1888, v. 1, p. 79, f. 15.) Scrophulariaceæ. H. alpine per. 4–5 in. high, glabrous, with thickish, entire, oblanceolate radical l., and scape like fl. stems, bearing 1–2 pairs of linear l., and a one-sided dense raceme of small, two-lipped, cream-coloured fl., bearded at the throat of the tube. Colorado.

Chorisia speciosa, St. Hil. (*Jard.* 1888, p. 270, with fig.) Malvaceæ. S. tree of ornamental character. L. on long petioles, digitate, leaflets 5–7, petiolulate, lanceolate acuminate, serrate. Fl. axillary, solitary, pedicillate; large and showy, 3 in. in diam. Calyx irregularly 2–4 lobed, glabrous and shining outside, silky inside. Pet. oblong obtuse, spreading, yellowish with dark brown rays at the base, densely pubescent on the back. Stamens in a long tube surrounding the style, with fertile anthers at the apex, and a whorl of barren anthers near the base. Brazil.

Chrysanthemum hæmatomma, Lowe. (*G. C.* 1888, v. 4, p. 36; and *W. G.* 1888, p. 341.) Compositæ. G. or H. H. suffrutescent species. L. 2–3 in. long, ¾–1 in. broad, pinnatisect, with about 3 pairs of oblong, obtuse, toothed lobes. Peduncles long and naked, bearing solitary fl.-heads 2–3½ in. in diam., with white or rosy rays, and a dark blood-purple disk. Madeira.

Chrysanthemum segetum, var. **grandiflorum.** (*W. G.* 1888, p. 246.) Garden variety.

Cissus mexicana, Prenger. (*B. T. O.* 1888, p. 298, f. 25.) Ampelideæ. H. H. or G. A species of vine, with tuberous rootstock and foliage similar to the ordinary grape vine. Mexico.

Cistus tauricus. (*H. G.* 1888, p. 558.) Cistaceæ. H. shr. A variety of **C. Creticus.**

Cleisostoma ringens, Rchb. f. (*G. C.* 1888, v. 4, p. 724.) Orchideæ. A pretty little species, with oblong emarginate l., 3–4 in long, 1½ in. broad, and a few flowered raceme of ochreous fl., having the middle lobe of the lip purple, and an orange spot on the side lobes. Sep. oblong, bluntly pointed; pet. narrower. Middle lobe of lip oblong, faintly warted, and with a large tubercle under the column; spur very large, broad, cylindrical, emarginate at the apex. Philippines.

Clematis coccinea, vars. **luteola,** André, and **parviflora,** Lavallée. (*R. H.* 1888, p. 348, with pl., and *H. G.* 1888, p. 462.) Ranunculaceæ. H. per. Var. **luteola** has the fl. yellow inside. Var. **parviflora** has smaller fl., reddish inside. Garden varieties.

Clematis mongolica. (*H. G.* 1888, p. 558.) H. Stated to be a very fine plant, with handsome yellow fl.

Clematis Pieroti, Miq. (*G. and F.* 1888, v. 1, p. 357.) H. climber, resembling *C. virginiana.* L. pinnate, with the leaflets deeply and sharply serrate, having prominent veins, and covered with appressed hairs. Fl. small white. Japan.

Clematis Sargenti, Laval. (*G. and F.* 1888, v. 1, p. 344.) H. A small-flowered form of **C. Pitcheri.** N. America.

Clerodendron cephalanthum, Oliver. (*G. C.* 1888, v. 3, p. 652.) Verbenaceæ. S. climber. A handsome plant, with brown stems, large ovate dark green l., the petioles of which harden and form stout hooks, and dense terminal heads of creamy-white fl. Calyx large, 5-lobed, purplish. Corolla with a narrow tube, 3–4 in. long, with spreading segments. Stamens much exserted. Zanzibar.

Clintonia Andrewsiana, Torr. (*G. C.* 1888, v. 3, p. 805.) Liliaceæ. H. per. with approximate, sessile, broadly ovate, glabrous l., resembling those of a *Colchicum*, and an erect scape about 2 ft. high, bearing an umbel of campanulate deep rose-coloured fl., on slender pedicels. California.

Clivia sulphurea, Laing. (*W. G.* 1888, p. 275.) Amaryllidaceæ. A garden form of **C. miniata.**

Cœlogyne graminifolia, Par. and Rchb. f. (*G. C.* 1888, v. 3, 168, and v. 4, p. 15; *B. M.*, t. 7006; *G. and F.* 1888, p. 300; and *H. G.* 1888, pp. 178 and 399.) L. 12–18 in. long, linear, leathery. Peduncles 4–5 in. long, 2–4 flowered. Sep. and pet. lanceolate, acute, white. Lip 3-lobed, side lobes white veined with brown, front lobe yellow tipped with white, the disk with 3 crisped keels, ending in brown lines. Burma.

Cœlogyne humilis, Lindl. var. **albata.** Rchb. f. (*G. C.* 1888, v. 3, p. 392, and *H. G.* 1888, p. 229.) A variety with white fl., having two orange spots and some radiating dotted lines on the lip.

Cœlogne lactea, Rchb. f. (*G. C.* 1888, v. 3, p. 521, and *H. G.* 1888, p. 281.) Much in the way of *C. flaccida.* Bulbs short, tumid, wrinkled, and ribbed, shining. L. cuneate oblong, acute, thick, 7–8 in. long, 1–2 in wide. Fl. like those of C. flaccida, creamy-white, with an ochreous lip marked with brown veins on the side lobes and some bright yellow at the base of the front lobe. Burmah.

Convolvulus californicus, Choisy. (*W. G.* 1888, p. 472.) Convolvulaceæ. H.H. per. twiner, with long-stalked saggittate, light green l., and large white fl., with canary yellow throat, on long peduncles. California.

Convolvulus chrysorhizus, Forst. (*W. G.* 1888, p. 288.) S. A variety of **Ipomœa batatas,** Lam.

Cordyline indivisa, var. **Doucetiana.** (*Ill. H.*, v. 35, p. 15, pl. 40; *H. G.* 1888, p. 232; *G. C.* 1888, v. 3, p. 563; and *G. and F.* 1888, v. 1, p. 204.) Liliaceæ. G. shr. A variety having the l. edged and striped with white. Syn. *Dracæna indivisa* var. *Loucetiana.*

Cornus sibirica, var. **Gouchaulti,** Carr. (*R. H.* 1888, p. 519.) Cornaceæ. H. shr. Garden variety, with variegated l.

Corydalis tuberosa, D. C. var. **alba.** (*G. C.* 1888, v. 3, p. 556.) Papaveraceæ. H. per. This is the plant cultivated as *C. cava*, var. *alba C. bulbosa*, var. *alba and C. Marshalliana.* Fl. white. Europe.

Cosmos hybridus. (*G. and F.* 1888, v. 1, p. 474.) Compositæ. H. annual, very attractive, attaining 6–7 ft. in height, with finely-cut l., and white or pale rosy fl.-heads, about 2½ in. in diam., in large terminal corymbs. Mexico.

Cratagus mexicana, var. **Carrieri,** Mast. (*G. C.* 1888, v. 4, p. 736, f. 104.) Rosaceæ. This is the seedling form of *C. mexicana* described in Revue Horticole 1883, p. 108, as *C. Carrieri.*

Cratægus tomentosa, L. (*G. and F.* 1888, v. 1, p. 249.) H. shr. or small tree, something like *C. coccinea*, but distinguished by its pale grey branches, almost without thorns; thicker l., without glands, densely pubescent beneath; and pubescent infl.; and also by its broader, looser corymbs, disagreeable odour, and later time of flowering and ripening its smaller, oblong, upright fr. United States.

Crinum Powelli, vars. **album** and **intermedium,** Gumbleton. (*G. C.* 1888, v. 4, p. 483.) Liliaceæ. Garden hybrids.

Crocosma aurea, var. **imperialis,** Leicht. (*W.G.* 1888, p. 340.) Iridaceæ. G. A stout form, growing to 3 ft. in height, and very floriferous, with fiery orange-red fl., nearly twice as large as in the type. S. Africa.

Crocosma aurea, var. **maculata,** Baker. (*G. C.* 1888, v. 4, pp. 407 and 565, f. 80; *H. G.* 1888, p. 549; and *W. G.* 1888, p. 435.) G. bulb. A handsome variety, with large orange fl., having the three inner segments marked near the base with a dark red-brown spot. Eastern S. Africa.

Crocus imperati, vars. **albiflora, atropurpurea, flore pleno, lilacina, pallida,** and **purpurea.** (*B. T. O.* 1888, p. 135.) Iridaceæ. Garden varieties.

Crocus imperati, var. **purpureus,** Damm. (*Gfl.* 1888, p. 465, t. 1280, f. 2, and *H. G.* 1888, p. 500.) H. A purple-flowered form.

Croton picturatum, André. (*R. H.* 1888, p 423.) Euphorbiaceæ. S. shr. A garden variety of **Codiæum variegatum.**

Cryptanthus Morrenianus, Regel. (*Gfl.* 1888, p. 157.) Bromeliaceæ. L. narrowed into a channelled petiole at the base, oblong-lanceolate, recurving; remotely spine-toothed, apex attenuate-cuspidate. Bracts slightly reddish, dusky-tomentose on the back, overtopping the sessile head of yellowish fl. Brazil. Syn. *Disteganthus Moensi,* Makoy.

Cryptogramme acrostichoides, R. Br. (*G. and F.* 1888, v. 1, p. 341.) Filices. G. or H. H. An attractive little fern, similar to *C. crispa,* but larger and stronger in growth, the barren segments thicker in texture, more prominently veined, and not so deeply cut, the fertile segments ⅜–½ in. long. N. America.

Cupressus Lawsoniana, var. **stricta.** (*B. T. O.* 1888, p. 230, f. 24.) Coniferæ. Garden variety.

Cycnoches versicolor, Rchb. f. (*G. C.* 1888, v. 4, p. 596.) Orchideæ. An interesting plant. Raceme several flowered. Sep. and pet. oblong, acute, the pet. a little the broadest, at first of a dark green, with darker veins, changing to deep brown. Lip oblong acute, convex, with an excavation near the base, having an erect tooth on each side, thick and fleshy, white, changing to yellowish, spotted on the apical part with purple. Brazil.

Cymbidium ensifolium, var. **estriatum,** Williams. (*Williams' Cat.* 1888, p. 20.) Orchideæ. A variety with narrow perianth segments. Sep. green, with a few red lines. Pet. white, with purple lines. Lip white, the front lobe yellow, with a few brown spots. Fl. very sweetly scented. Assam.

Cynosorchis elegans, Rchb. f. (*G. C,* 1888, v. 3, p. 424, and *H. G.* 1888, p. 279.) Orchideæ. A small terrestrial orchid, with light green oblong-lanceolate acute l., 2 in. long, ½ in. broad, striped and barred with purple beneath. Raceme with a few small white and rosy-tinted fl., marked with deep purple spots and lines on the 3-lobed lip; spur slender, shorter than the ovary. Madagascar.

Cynosorchis Lowiana, Rchb. f. (*G. C.* 1888, v. 3, p. 424, and *H. G.* 1888, p. 280.) A small terrestrial orchid, with cuneate-oblong acuminate l., about a span long, and nearly ¾ in. broad, dark green. Scape slender, with a few small fl. Sep. and pet. whitish green. Lip 4-lobed, lilac, with an obcordate dark purple spot. Madagascar.

Cyperorchis elegans, Blume. (*B.M.,* t. 7007; *G. C.* 1888, v. 4, p. 15; *H. G.* 1888, p. 399; and *G. and F.* 1888, p. 300.) Orchideæ. This is the *Cymbidium elegans.* Lindl.

Cyperus distans, var. **spiraliformis.** (*W. G.* 1888, p. 31.) Cyperaceæ. H. Not described, but compared with *Juncus spiralis* as to habit.

Cypripedium, see also **Selenipedium.**

Cypripedium Arthurianum, var. **pallidum,** Linden. (*L.,* v. 3, p. 53, pl. 121.) Orchideæ. Garden hybrid.

Cypripedium Atys, Rolfe. (*G. C.* 1888, v. 4, p. 6, and *H. G.* 1888, p. 397.) Garden hybrid.

Cypripedium bellatulum, Rchb. f. (*G. C.* 1888, v. 3, pp. 648 and 747, f. 99; and v. 4, p. 215; *B. T. O.* 1888, p. 307; *H. G.* 1888, pp. 456 and 555; *L.,* v. 4, p. 13, pl. 149; *O.* 1888, p. 256; and *W. G.* 1888, p. 468.) A large-flowered form of **C. Godefroyæ,** with large spots.

—— var. **egregium,** Rchb. f. (*G. C* 1888, v. 4, p. 122, and *H. G.* 1888 p. 456.) A form with a short, nearly trilobed sep., and light purple spots.

Cypripedium Berggrenianum, Rchb. f. (*G. C.* 1888, v. 3, p. 798, and *H. G.* 1888, p. 396.) Garden hybrid.

Cypripedium Burfordiense, Rchb. f. (*G. C.* 1888, v. 4, p. 724.) Garden hybrid.

Cypripedium caligare, Rchb. f. (*G. C.* 1888, v. 3, p. 264; *H. G.* 1888, p. 226; and *O.* 1888, p. 130.) Garden hybrid.

Cypripedium callosum, var. **sublæve,** Rchb. f. (*G. C.* 1888, v. 3, p. 331, and *H. G.* 1888, p. 228.) A variety without any spots on the disk of the pet.

Cypripedium Canhami. (*W. G.* 1888, p. 32.) Garden hybrid.

Cypripedium Cannartianum, Lind. (*L.*, v. 3, pp. 93 and 141.) A variety of **C. philippinense,** with 3 sepals, the lower sep. being 2-lobed, or the two component seps. being fully developed. Syn. *C. Roebellini*, var. *Cannartianum*, Lind.

Cypripedium chelseense, Rchb. f. (*G. C.* 1888, v. 4, p. 406, and *H. G.* 1888, p. 549.) Garden hybrid.

Cypripedium chlorops, Rchb. f. (*G. C.* 1888, v. 3, p. 584, and *H. G.* 1888, p. 308.) Syn. *Selenipedium chlorops*, Rchb. f. Garden hybrid.

Cypripedium ciliolare, var. **Miteauanum,** Linden. (*L.*, v. 3, p. 78, and v. 4, p. 7, pl. 146.) A variety having the whole fl., except the lower sep., suffused with a rich purple hue. Philippines. Syn. *C. Miteauanum*, Linden and Rod.

Cypripedium concolor, var. **sulphurinum,** Rchb. f. (*G. C.* 1888, v. 4, p. 264, and *H. G.* 1888, p. 504.) A green-leaved var., with light sulphur-coloured fl. without spots, but with two darker yellow marks on the staminode.

Cypripedium conspicuum, Rchb. f., and var. **pictum,** Rchb. f. (*G. C.* 1888, v. 3, p. 521, and *H. G.* 1888, p. 281.) Garden hybrids.

Cypripedium Dauthieri, var. **Rossianum,** Rchb. f. (*G. C.* 1888, v. 3, p. 425; *H. G.* 1888, p. 280; and *B. T. O.* 1888, p. 136.) Garden hybrid.

Cypripedium dilectum, Rchb. f. (*G. C.* 1888, v. 3, p. 330, and *H. G.* 1888, p. 228.) Intermediate between *C. Boxallii* and *C. hirsutissimum.* Upper sep. light green, with rows of blackish-purple spots, and a white apical margin. Pet. broadest at the apex, mid line blackish, the part above it purple-mauve, the part below it green, with obscure reticulations; the base is spotted with blackish. Lip yellowish-green, spotted inside with blackish-purple. Staminode narrower than in *C. Boxallii*, 3-lobed at the apex. Ovary densely hairy, equalling the bract.

Cypripedium Electra, Rolfe. (*G. C.* 1888, v. 3, p. 297, and *H. G.* 1888, p. 227.) Garden hybrid.

Cypripedium Elliottianum, Rchb. f. (*G. C.* 1888, v. 4, pp. 501, 532, and 556, with fig.) A handsome and distinct species, belonging to the same group as *C. Stonei*, *C. Rothschildianum*, &c. L. 12-15 in. long, $1\frac{1}{2}$–2 in. broad, bright green. Scape a ft. or more high, 2–5 flowered. Upper sep. elliptic, acute, flat, white, with dark purple brown stripes. Lower sep. broadly ovate, coloured like the upper sep. Lip similar to that of *C. Stonei*, rosy-tinted. Pet. 5–6 in. long, broadly linear at base, tapering into narrow tails, white, spotted with chocolate. Staminode linear, bifid at apex, bent downwards. Philippines.

Cypripedium fasciculatum, Kell. (*G. and F.* 1888, v. 1, p. 90, f. 16, and p. 138.) H. terrestrial. A small-flowered species of no great beauty, 3–12 in. high, with a pair of ovate or broadly-elliptic l., and a 1–4-flowered spike of fl. about 1–$1\frac{1}{2}$ in. in diam. Sep. and pet. lanceolate, acute, greenish. Lip 4-5 in. long, greenish-yellow, with a purple-brown margin. N.W. America.

Cypripedium Fitchianum, Will. (*W. O. A.*, v. 8, pl. 350; *Williams' Cat.* 1888, p. 20; and *G. C.* 1888, v. 4, p. 600.) Garden hybrid.

Cypripedium Galatea, Rolfe. (*G. C.* 1888, v. 3, p. 168; *H. G.* 1888, p. 178; and *O.* 1888, p. 132.) Garden hybrid.

Cypripedium Godseffianum, Rchb. f. (*G. C.* 1888, v. 3, p. 296, and *O.* 1888, p. 133.) Garden hybrid.

Cypripedium Harrisanum, var. **superbum,** Veitch. (*L.*, v. 3, p. 47, pl. 118; *G. C.* 1888, v. 3, p. 235; and *W. G.* 1888, p. 109.) Garden hybrid.

Cypripedium hephæstus, Kent. (*G. C.* 1888, v. 3, p. 425, and *H. G.* 1888, p. 280.) Garden hybrid.

Cypripedium Houtteanum. (*G. C.* 1888, v. 3, p. 561.) See **C. Vanhoutteanum.**

Cypripedium insigne, var. **Horsmanianum,** Rchb. f. (*G. C.* 1888, v. 4, p. 693.) Garden variety, with narrow fl., and a beak in the middle of the mouth of the lip.

Cypripedium insigne, var. **Sanderæ,** (*G. C.* 1888, v. 4, pp. 606 & 692). A variety with clear citron yellow, wax-like, shining fl., having the apical third of the upper sep. white and a few brown dots along the central nerve.

Cypripedium Lathamianum, Rchb. f. (*L.* v. 3, p. 74 : *G. C.* 1888, v. 3, p. 360; and *H. G.* 1888, p. 228.) Garden hybrid.

Cypripedium Lawrenceanum, var. **pleioleucum,** Rchb. f. (*G. C.* 1888, v. 3, p. 744; and *H. G.* 1888, p. 370.) Garden variety.

Cypripedium Leeanum, var. **maculatum,** (*G. and F.* 1888, v. 1, p. 4.) Garden hybrid.

Cypripedium Lemoinierianum, (*G. C.* 1888, v. 3, p. 712 ; and *H. G.* 1888, p. 370.) Garden hybrid.

Cypripedium margaritaceum, Franchet (*O.* 1888, p. 368, with pl.) A very distinct and remarkable species. Rhizome elongate. Stem short with two sub-opposite broadly elliptic l. at the middle, of a somewhat glaucous green, spotted with purplish brown. 5–9 nerved. Peduncle 1-flowered 3 in. long, glabrous. Sep. elliptic, the upper one broadest; pet oblong lanceolate acute, all shortly ciliate on the margins, and all of a deep purple colour marked with rows of blackish-purple spots. Lip very remarkable, slightly concave above, with a circular, crenulated orifice, formed by the short airicles overlapping each other, keeled beneath, dark brown covered with small tubercles. Staminode deflexed, cordate. Yunnan, China.

Cypripedium Miteauanum, Lind. and Rod. (*L.* v. 4, p. 7, p. 146; *G. C.* 1888, v. 4, p. 326 ; and *H. G.* 1888, p. 502.) *See* **C. ciliolare** var. **Miteauanum,** Lind.

Cypripedium Moensianum, Linden. (*L.* v. 3, p. 69, p. 129 ; and *G. C.* 1888, v. 3., p. 561.) A beautiful plant, very similar to *C. argus,* and probably a variety of that species, differing in its broader upper sep., and pet. which are marked with larger and more numerous spots, the upper sep. is also spotted along the nerves. Philippines.

Cypripedium nitidissimum, Rchb. f. (*G. C.* 1888, v. 4, p. 6 ; and *H. G.* 1888, p. 396.) Garden hybrid. Syn. *Selenipedium nitidissimum,* Rchb. f.

Cypripedium Pageanum, Rchb. f. (*G. C.* 1888, v. 4, p. 264 ; *H. G.* 1888, p. 504 ; and *O.* 1888, p. 257.) Garden hybrid.

Cypripedium pavoninum, Rchb. f. (*G. C.* 1888, v. 3, p. 264 ; *H. G.* 1888, p. 226 ; and *O.* 1888, p. 132.) Garden hybrid.

Cypripedium Petersianum, Rchb. f. (*G. C.* 1888, v. 3, p. 331 ; and *H. G.* 1888, p. 228.) Garden hybrid.

Cypripedium Pitcherianum, Manda. (*American Florist* 1887, v. 3, p. 178 ; *G. C.* 1888, v. 3, p. 42 ; *H. G.* 1888, p. 127 ; and *O.* 1888, p. 97.) Allied to *C. barbatum.* L. 5 in. long, $2\frac{1}{2}$ in. broad, acute, green tessellated with dark green. Scape a ft. or more high, 1-flowered. Bract 1 in. long green. Ovary, $1\frac{3}{4}$ in. long, green, curved. Upper sep. 2 in. long and nearly as broad, acuminate, whitish with bright green veins and spotted with dark purple-brown. Pet. deflected, $2\frac{1}{2}$ in. long, $\frac{3}{4}$ in. broad, whitish, changing to purple towards the tips, veined with green, the inner part spotted, and both edges warted with blackish-brown, edges ciliate. Lip light purple with darker veins. Staminode horseshoe - shaped with incurved points, purplish. Philippines. [Perhaps the same as **C. argus,** Rchb. f.—*N. E. Br.*]

Cypripedium polystigmaticum, Rchb. f. (*G. C.* 1888, v. 4, p. 407 ; and *H. G.* 1888. p. 549.) Garden hybrid.

Cypripedium Rothschildianum, Rchb. f. (*G. C.* 1888, v. 3, p. 457 ; *H. G.* 1888, p. 280 ; and *W. G.* 1888, p. 241.) Allied to *C. glanduliferum* (*C. præstans*). L. 2 ft. or more long, $2\frac{1}{2}$–3 in. broad, glossy green. Scape 3 or more flowered. Upper sep. oblong acute, yellowish with numerous very dark brown stripes, and white borders. Pet. linear with a wavy base, yellowish-green with dark lines and blotches at the base. Lip like that of *C. Stonei* brown with an ochreous border to the mouth. Staminode stout at base, rising erect and then bending down into a beak-like hairy process. New Guinea.

Cypripedium Savageanum, O'Brien (*G. C.* 1888, v. 4, p. 407 ; and *H. G.* 1888, p. 549.) Garden hybrid.

Cypripedium Tautzianum, var. **lepidum,** Rchb. f. (*G. C.* 1888, v. 4, p. 756.) Garden hybrid.

Cypripedium variopictum, Rchb. f. (*G. C.* 1888, v. 4, p. 407 ; and *H. G.* 1888, p. 549.) Garden hybrid.

Cypripedium Vanhoutteanum, Hye. (*L.* v. 3, p. 71, pl. 130 ; and *G. C.* 1888, v. 3, p. 561, as *C. Houtteanum.*) Garden hybrid.

Cypripedium Vervaetianum, Rchb. f. (*G. C.* 1888, v. 3, p. 712 ; and *H. G.* 1888, p. 370.) Garden hybrid.

Cyrtanthus lutescens, Herb. (*G. C.* 1888, v. 3, p. 172.) Amaryllidaceæ. G. bulb, similar in appearance to *C. Mac-*

kenii. Umbel 3–4 flowered; fl. funnel-shaped, 2 in. long pale yellow. S. Africa.

Cytisus albus, var. **multiflorus.** (*W. G.* 1888, p. 391.) Leguminosæ. H. shr. Garden variety.

Dahlia gracilis flore pleno. (*W. G.* 1388, p. 470.) Compositæ. Garden variety.

Decaschistia ficifolia, Mart. (*G. C.* 1888, v. 4, p. 565.) Malvaceæ. S. A handsome shr. with 3-lobed l., cuneate at base, the lobes toothed, hoary beneath. Fl. 3-in or more in diameter, coppery-red, merging into yellow, with a rosy spot at the base. Birma.

Delphinium nudicaule, var. **aurantiacum.** (*W. G.* 1888, p. 436.) Ranunculaceæ. Garden variety.

Delphinium viride, S. Wats. (*G. and F.* 1888, v. 1, p. 149 and 150, f. 29; and *W. G.* 1888, p. 342.) H. annual on biennial, with palmately cut and toothed l., and laxly racemose fl., with the sep. and the long stout spur yellowish-green and the pet. deep purple. Chihuahua.

Dendrobium aphrodite, Rchb. f. (*Veitch Man. Dendrob.* p. 17.) Orchideæ. This is the first published name for *D. nodatum,* Ldl.

Dendrobium aureum, var. **album,** Veitch. (*Veitch Man. Dendrob.* p. 20.) Fl. very pale nearly white.

—— Var. **aurantiacum,** Veitch. (*Veitch Man. Dendrob.* p. 20.) Fl. orange-yellow.

—— Var. **Henshalli,** Veitch. (*Veitch Man. Dendrob.* p. 19.) This is the plant figured in Botanical Magazine t. 4970, as *D. heterocarpum* var. *Henshalli.*

Dendrobium Brymerianum, var. **histrionicum,** Rchb f. (*G. C.* 1888, v. 3, p. 104; *H. G.* 1888, p. 128; *O.* 1888, p, 225; and *Veitch Man. Dendrob.* p. 25.) An autumn flowering form, which sometimes has a fringe to the lip, at other times no fringe. Bhamo.

Dendrobium crassinodi-Wardianum, Veitch. (*Veitch Man. Dendrob.* p. 32.) A synonym of **D. melanophthalmum,** Rchb. f.

Dendrobium chryseum, Rolfe. (*G. C.* 1888, v. 3, p. 233; *H. G.* 1888, p. 180; *O.* 1888, p. 166; and *Veitch Man. Dendrob.* p. 28.) Stems 1½ feet high, slender. L. 3–4 in. long, linear-lanceolate. Racemes lateral, 2–3 flowered. Fl. rich golden yellow. Sep. oblong, 1½ in. long. Pet. broad, elliptic. Lip. orbicular, minutely pubescent, and minutely fringed. Assam.

Dendrobium chrysodiscus, var. **oculatum,** Veitch. (*Veitch Man. Dendrob.* p. 87.) Garden hybrid.

Dendrobium doreyanum, L. Linden. *L'Hort. Int. Cat.* 1888–9, p. 48.) New Guinea. No description.

Dendrobium gratiosissimum, Rchb. f. (*Veitch Man. Dendrob.* p. 47.) An earlier name for *D. Bullerianum.*

Dendrobium Griffithianum, var. **Guibertii,** Veitch. (*Veitch Man. Dendrob.* p. 48.) This is the *D. Guibertii,* Carr. now referred as a variety of *D. Griffithianum.*

Dendrobium infundibulum, var. **Jamesianum,** Veitch. (*Veitch Man. Dendrob.* p. 50.) This is the *D. Jamesianum* Rchb. f.

Dendrobium Kingianum, var. **album,** Williams and Warner. (*W. O. A.* v. 7, pl. 332; and *G. C.* 1888, v. 3, p. 801.) A white flowered variety. Australia.

Dendrobium Lansbergeanum, L. Linden. (*L'Hort. Int. Cat.* 1888–9, p. 49.) New Guinea. No description.

Dendrobium macrophyllum, a Rich. var. **stenopterum,** Rchb. f. (*G. C.* 1888, v. 3, p. 393; and *H. G.* 1888, p. 229.) A variety with narrow triangular side lobes to the lip, which is yellow, with some pallid spots and markings on the front lobe, and a few brown lines on the side lobes. The sep. and pet. are ochre-yellow, dotted on the outside with dark reddish-brown. It also occurs with yellow fl.

Dendrobium moschatum, var. **calceolaria,** Veitch. (*Veitch Man. Dendrob.* p. 62.) A synonym of **D. moschatum** var. **cupreum,** Williams.

Dendrobium murrhiniacum, Rchb. f. (*G. C.* 1888, v. 3, p. 554; and *H. G.* 1888, p. 308.) Garden hybrid.

Dendrobium nobile, var. **elegans,** Veitch. (*Veitch Man. Dendrob.* p. 64.) A large flowered form with broader pet. white at the base, and the lip with a pale yellow zone around the maroon-coloured disk and the apical margin rosy-purple.

—— Var. **Sanderianum,** Rchb. f. (*G. C.* 1888, v. 3, p. 554; *H. G.* 1888, p. 308; and *R.* v. 2, p. 21, t. 58.) A variety with bright purple, sep. and pet. white at their base. Lip with a large dark blotch on the disk, rosy-purple on each side of it, and a white area in front with purple veins.

—— Var. **Schrœderianum,** Veitch. (*Veitch Man. Dendrob.* p. 64.) A large flowered variety with broad segments, sep. and pet. white, sometimes tipped with amethyst-purple. Lip. with rich maroon-purple disk bordered with pale yellow, and a white margin.

Dendrobium Pitcherianum, Rchb. f. (*G. C.* 1888, v. 3, p. 392; and *H. G.* 1888, p. 229.) Stems like those of *D. nobile.* Sep. oblong, obtuse, whitish-rosy with purple tips. Pet. broader with a deep purple tip and rosy mid line. Lip cordate-oblong in outline, involute at the base, with a flat border, hairy, light yellow, with a purple tip and lines on each side of the thickened mid line.

Dendrobium porphyrogastrum, Rchb. f. (*Veitch Man. Dendrob.* p. 90.) Garden hybrid.

Dendrobium sphegidoglossum, Rchb. f. (*G. C.* 1888, v. 4, p. 179.) This is a synonym of **D. stuposum,** Lindl. It has spindle-shaped stems about 9 in. high, narrow oblong obtuse l., and rather small yellowish-white fl., the lip having an orange-red tip and some red veins on the sides. Upper sep. lanceolate, acute; side sep. elongate-triangular, acute; pet. lanceolate, obtuse; lip narrow, 3-lobed, fringed with curled hairs. Burma, Siam.

Dendrobium splendidissimum, var. **grandiflorum,** Veitch. (*Veitch Man. Dendrob.* p. 91.) Garden hybrid.

Dendrobium strebloceras, var. **Rossianum,** Rchb. f. (*L.* v. 3, p. 59, pl. 124; *B. T. O.* 1888, p. 92; *G. C.* 1888, v. 3, p. 72; *H. G.* 1888, p. 127; *O.* 1888, p. 193; and *L'Hort. Int. Cat.* 1888–9, p. 43.) A variety with white fl., the pet. pale greenish tinted, and the lip. and sep. changing to yellowish. New Guinea.

Dendrobium Wattii, Rchb. f. (*G. C.* 1888, v. 4, p. 724.) This is the plant figured in the Botanical Magazine t. 6716 as *D. cariniferum* var. *Wattii,* Hook. f.

Dendrophylax Fawcetti, Rolfe. (*G. C.* 1888, v. 4, p. 533.) Orchideæ. Much in the way of D. funale. A leafless plant with a tuft of long green roots springing from a very short stem, from which arises a scape varying from 2–23 in. long, bearing several fl. 2 in. in diam. Sep. and pet. lanceolate, acute, delicate greenish-white; lip 2-lobed, white, with a slender spur 7 in. long. Cayman Islands.

Dianthus plumarius scoticus flore pleno. (*W. G.* 1888. p. 242.) Garden variety.

Diastema picta, Regel. (*Gfl.* 1888, p. 240.) Gesneraceæ. S. per. A pretty little herb 6–9 in. high, softly hairy; with scaly rhizomes like those of an *Achimenes;* erect branching stems; opposite, petiolate, ovate or lanceolate crenate l., with 1-3 pedicellate fl. in their axils. Calyx lobes oblong-elliptic Corolla campanulate-tabular ¾ in. long; the tube white, dotted with purple; the limb spreading, white, with the lower lobe marked with a dark purple spot. Andes of Columbia

Dichorisandra pubescens, var. **tæniensis,** (*G. C.* 1888, v. 3, p. 557, f. 75; *B. T. O.* 1888, p. 306; *G. and F.* 1888, v. 1, p. 204, as var. *talmiensis*; *H. G.* 1888, p. 308; *R. H.* 1888, p. 249, f. 57; and *W. G.* 1888, p. 281.) Commelinaceæ. S. per. A pretty foliage plant, with lanceolate acuminate l. of a rich green, striped with white, and short terminal spike-like panicles of blue and white fl. Brazil.

Diervilla sessilifolia, Buckl. (*G. and F.* 1888, p. 273.) Caprifoliaceæ H. A handsome shr. with sessile l., and many-flowered cymes of showy yellow fl. Eastern United States.

Dipodium paludosum, Rchb. f. (*G. C.* 1888, v. 4, p. 91; and *H. G.* 1888, p. 398.) Orchideæ. L. distichous, oblong, acute, membranous. Scapes long, with a raceme of 10–12 fl. Sep. and pet. lanceolate-acute, creamy-white, spotted with purple. Lip cuneate-oblong, obtuse, velvetty down the centre, and with two teeth at the base, white, with the side parts of the front lobe marked with purple lines. Cambodia, Malacca, Borneo.

Disa lacera, Sw. (*G. C.* 1888, v. 4, pp. 664 and 707.) Orchideæ. G. Terrestrial Orchid of interesting character. L. linear-filiform. Fl. stem 10–12 in. high, leafless, with a few sheaths, and several blue fl. in a lax raceme. Upper sep. helmet-shaped, with a short spur; side sep. obliquely oblong, somewhat boat-shaped. Pet. with a broad basal lobe and a narrow very abruptly hooked apical part. Lip oblong, lacerate, or fringed at the apex only, or nearly, or quite entire. S. Africa.

—— Var. **multifida,** N. E. Br. (*G. C.* 1888, v. 4, p. 664, f. 93.) Differs only in having the lip more or less deeply fringed from base to apex. S. Africa.

Disteganthus Moensi, Makoy. See **Cryptanthus Morrenianus,** Regel.

Dodecatheon splendidum. (*W. G.* 1888, p. 205–6, f. 44.) Primulaceæ. A garden form of **D. meadia,** L.

Douglasia lævigata, A. Gr. (*B. M.* t. 6996; *G. C.* 1888, v. 3, p. 524–5, f. 71; *G. and F.* 1888, v. 1, p. 204; and *H. G.* 1888, pp. 282, 311.) Primulaceæ. H. alpine per., about 2 in. high, densely tufted. L. ½–¾ in. long, linear-lanceolate, entire, in small rosettes. Scapes slender, with a rosette of bracts at the apex, from which arise 2–5, long pedicelled, Primrose-like pink fl., ⅓ in. in diam. Calyx campanulate, with ovate teeth. Oregon.

Dracæna argenteo-striata, Bull. (*Bull. Cat.* 1888, p. 8; and *W. G.* 1888, p. 332.) Liliaceæ. S. shr. An ornamental foliage plant, with narrow, linear-lanceolate, bright green l., striped with creamy-white and silvery grey. Seems to be a **Cordyline.** South Sea Islands.

Dracæna Barteti. (*R. H.* 1888, p. 530.) Garden variety.

Dracæna indivisa, var. **Doucetiana,** Rodigas. (*Ill. H.* v. 35, p. 15, pl. 40; and *H. G.* 1888, p. 232.) See **Cordyline indivisa.**

Dracæna Poubellei. (*R. H.* 1888, p. 530.) Garden variety.

Echinocactus Haselbergii, Forst. (*B. M.* t. 7009; *G. C.* 1888, v. 4, p. 186; *G. and F.* 1888, v. 1, p. 371; and *H. G.* 1888, p. 459.) Cactaceæ. G. succulent. An elegant species, with a globose, many angled stem, 2–2½ in. in diam., with tufts of short spreading whitish spines, and brilliant orange-red fl. an in. in diam.

Echinocactus texensis, Hopfer. (*Gfl.* 1888, p. 633, t. 1286.) Cactaceæ. G. succulent. A distinct and pretty species. Stem depressed-globose 5–6 in. in diam., with many acute angles, bearing very distant tufts of about 8 stout brown spines, ½–¾ in. long, transversely ridged. Fl. from the axils of the younger spine-tufts 2–2½ in. in diam., of a delicate rosy-pink. Pet. oblanceolate, beautifully fringed. Berry 1 in. in diam., depressed globose, scarlet, bearing a few spines on the top. Texas.

Eichornia crassipes, Solms. (*Gfl.* 1888, p. 225, t. 1271.) Pontederiaceæ. This is the corrected name for the well known ornamental S. aquatic, *Pontederia crassipes,* Mart.

Elæagnus Simoni, var. **tricolor.** (*W. G.* 1888, p. 164.) Elæagneæ. Garden variety.

Epidendrum auriculigerum, Rchb. f. (*G. C.* 1888, v. 4, p. 84; and *H. G.* 1888, p. 397.) Orchideæ. Much like *E. brassavola,* with long narrow sep. and pet. The lip is auricled near the base, the front lobe is triangular acuminate, and there are two long swollen keels between the auricles, and three short ones in front.

Epidendrum O'Brienianum, Rolfe. (*G. C.* 1888, v. 3, p. 770, 771, f. 103; and *H. G.* 1888, p. 371.) Garden hybrid.

Epidendrum Stamfordianum, var. **Leeanum,** Rchb. f. (*G. C.* 1888, v. 3, p. 521; and *H. G.* 1888, p. 281.) A variety in which the ochreous sep. and pet., and the pale rose-coloured lip is spotted with purple.

Epidendrum tampense, Lindl. (*G. C.* 1888, v. 4, p. 150; and *H. G.* 1888, p. 457.) A small slender species, with small ovoid bulbs, linear l. 6 in. long, and a slender scape, bearing several fl. of about 1¼ in. in diam. Sep. and pet. cuneate-linear yellowish-brown. Lip with linear side lobes, and a rounded obtuse front lobe, white, with purple lines that are more or less confluent. Florida.

Eria bicolor, Lindl. (*G. C.* 1888, v. 3, p. 9; and *O.* 1888, p. 263.) Orchideæ. A pretty species, with stout stems 4–5 in. long, very timid at the base, bearing 5–7 narrow, cuneate-lanceolate, acuminate, stiff l. as long as the stem, standing nearly erect at the top, and one-sided racemes of pure white fl., having white bracts and pubescent purple ovaries and rachis. Sep. triangular acuminate; pet. narrower; lip sigmoid, trifid, side lobes blunt, mid lobe acute, no keels or ridges. Ceylon.

Eria striolata, Rchb. f. (*Ill. H.* v. 35, p. 35, pl. 48; *G. C.* 1888, v. 3, p. 554; and *H. G.* 1888, pp. 308, 373.) Allied to *E. stellata,* Lindl., with short bulbs, broad cuneate-oblong acute l., and a stout, erect raceme of moderate sized fl. Sep. and pet. linear acute, ochreous, striate, with purple, the sep. sparsely hispidulous outside. Lip oblong, 3-lobed, 3-keeled. New Guinea.

Erica sicula, Guss. See **Pentapera sicula,** Kl.

Eriostemon obovalis, flore pluralis. (*W. G.* 1888, p. 118.) Rutaceæ. Garden variety.

Erythronium Hendersoni, S. Wats. (*B. M.* t. 7017; *G. C.* 1888, v. 3, pp. 652, 653, f. 86; and v. 4, p. 301; *G. and F.* 1888, v. 1 p. 317, f. 50; *H. G.* 1888, pp, 310, 506; and *W. G.* 1888, p. 433.) L. two, ovate, or ovate-lanceolate obtuse, dull green, faintly spotted with brown. Scape 6–8 in. long, 1–2-flowered. Fl. drooping, 1½ in. in diam., the segments lanceolate, recurving, pale lilac, with a dark purple spot at the base. Oregon. [This is a synonym of **E. revolutum,** Smith, as shown by Menzies specimen in the Kew Herbarium. N. E. Brown.

Esmeralda bella, Rchb. f. (*G. C.* 1888, v. 3, p. 136; *Bull, Cat.* 1888, p. 8; *H. G.* 1888, p. 176; *L'Hort. Int. Cat.* 1888-9, p. 49; and *O.* 1888, p. 194. Orchideæ. A fine plant, with short, broad, shining l., unequally bilobed at the apex, and fl. similar in form to those of *E. Cathcarti*. Sep. and pet. straight, light ochre, barred with brown. Lip white, margined with brown on the very broad tumid front lobe, and striped with purple-brown on the side lobes. There is a roundish basal tubercle, and a long, tumid, ligulate body, extending nearly to the apex, where there is another roundish tubercle.

Eucalyptus urnigera, Hook. f. (*G. C.* 1888, v. 3, p. 460, f. 64; and *G. and F.* 1888, v. 1, p. 168.) Myrtaceæ. H. tree. L. narrow lanceolate acute, dull green, coriaceous, 3 in. long, $\frac{3}{4}$ in. broad, on petioles 1 in. long. Peduncles axillary $\frac{1}{4}$–$\frac{1}{3}$ in. long, 1–4-flowered. Buds elongate-pear-shaped, with a short conical cap. Fr. about $\frac{1}{2}$ in. long, somewhat urn-shaped. Tasmania.

Eucharis grandiflora, var. **Moorei,** Baker. (*G. C.* 1888, v. 4, p. 628.) Amaryllidaceæ. S. bulb. A distinct plant, with roundish l., much smaller than in E. grandiflora, the fl. are also rather smaller, having the corona white inside, with a fine yellow line where the filaments run down, the teeth between the filaments are large and acute.

Eulophia gigantea, N. E. Br. Orchideæ. S. terrestrial Orchid. A fine handsome plant, growing several ft. high. L. 3–4 ft. long, cuneate, oblong-acuminate plicate. Raceme lax. Fl. $2\frac{1}{2}$ in. in diam. Sep. narrow, cuneate-oblong, greenish. Pet. very large, elliptic-oblong, lilac. Lip with a very stout, short, blunt spur, and 3 yellow keels on the disk at the base of the broad rounded front lobe, which is purple with darker stripes. W. Trop. Africa. Syn. *Lissochilus giganteus,* Welw. (*G. C.* 1888, v. 3, p. 616–7, f. 83, and v. 4, p. 353.)

Eulophia Ledienii, Stein. (*Gfl.* 1888, p. 609, t. 1285, *as E. maculata.*) A distinct looking Orchid, with ovoid, grooved bulbs an in. long, bearing one cuneate-oblong l. 3–4 in. long, by $1\frac{1}{2}$ in. broad, handsomely variegated, with irregular bands of dark green and greyish; and an erect slender lax spike of not very large fl. Sep. lanceolate acute reddish brown. Pet. narrower erect white, forming with the upper sep. a kind of hood. Lip with erect side lobes, a broadly ovate front lobe, white, with two red spots. Lower Congo. [This plant is also quoted as *E. maculata*, Rchb. f. at the above place, but it is distinct from the Mauritian and Brazilian species, both of which are included under E. maculata, by Reichenbach. It seems therefore, best to retain the name above given for it.—*N. E. B.*]

Eustrephus Brownii, Mueller. (*Gfl.* 1888, p. 596, p. 132.) Liliaceæ. G. climber. A synonym of **E. latifolius.**

Exocarpus cupressiformis, Labill. (*Gfl.* 1888, p. 288, f. 60.) Santalaceæ.

Fagus purpurea, var. **roseo-marginata.** (*G. C.* 1888, v. 3, p. 779.) Cupuliferæ. A garden variety of the Copper Beech, with a pink edge to the young l.

Fagus sylvatica conglomerata Bandrilleri. (*W. G.* 1888, p. 347; and *G. and F.* 1888, v. 1, p. 468.) Garden variety.

Fendlera rupicola, Eng. and Gr. (*G. and F.* 1888, v. 1, p. 236.) Saxifragaceæ. H. shr., 2–4 ft. high, with small, opposite, entire, subsessile l., and solitary, large, white, showy fl., with long conspicuous stamens. New Mexico.

Ficus Canoni, N. E. Br. (*G. C.* 1888, v. 3, p. 9; and *H. G.* 1888, p. 124.) Urticaceæ. S. shr. This is the plant known in gardens as *Artocarpus Canoni,* referred to its right genus. Society Islands.

Fuchsia semperflorens, Rozain. (*W. G.* 1888, p. 244.) Onagrarieæ. Garden hybrid.

Galanthus. For notes on the species of this genus, see *Le Jardin* 1888, p. 139–140.

Galanthus corcyrensis, Leicht. (*Jard.* 1888, p. 139.) H. bulb. A small variety of **G. nivalis.** Corfu.

Galanthus nivalis, var. **serotinus,** of Gardens. (*Jard.* 1888, p. 140.) A late flowering variety.

Galanthus Olgæ, Orph. (*Jard.* 1888, p. 140; and *G. and F.* 1888, v. 1, p. 499, as *G. Reginæ Olgæ,* and *G Olgæ Reginæ.*) H. bulb, flowering in autumn. L. 6–8 in. long, $\frac{1}{4}$ in. broad, very glaucous beneath. Fl. large, white, without spots on the inner segments? Greece.

Galanthus Sharlocki, Casp. (*G. C.* 1888, v. 3, p. 243.) H. bulb. A snowdrop, with green lines on the outer perianth segments, and two upright, green, leaf-like bracts. Europe.

Gentiana calycosa, Griseb. (*Gfl.* 1888, p. 193, t. 1270, f. a–c; *G. C.* 1888, v. 3, p. 563; and *H. G.* 1888, p. 279.) H. per., with erect unbranched stems, 4–6 in. high, bearing opposite, subconnate, ovate l. an in. long; and a solitary fl. about $1\frac{1}{2}$ in. long, with spreading corolla lobes, alternating with narrow bifid processes; deep blue dotted at the base of the lobes with white. California and Oregon.

Gentiana carpathica, Kit. (*Jard.* 1888, p. 113.) H. per. [No description given, and in the original description of Kitaibel it merely states that the l. are obovate, sessile, and the upper ones distant; the fl. are sessile, with a transparent veiny calyx. Carpathian Alps. N. E. Brown.]

Gentiana Charpentieri, Thomas. (*Jard.* 1888, p. 76.) H. per., very similar to *G. lutea*, and supposed to be a hybrid between that species and *G. punctata.* The calyx is 5-toothed, and the corolla yellow, dotted with red. Alps, Switzerland.

Gentiana Clusii, Perr. and Song. (*W. G.* 1888, p. 180, and p. 178, f. 36.) H. alpine per., something like *G. acaulis.* L. in a rosette, lanceolate acute. Peduncle 1–2 in. high. Fl. solitary, large, dark blue, with short, slightly spreading lobes. Calyx without folds between the lanceolate acuminate lobes. Alps.

Gentiana Froelichii, Jan. (*Jard.* 1888, p. 125.) H. per. An acaulescent Gentian, with a rosette of rather thick, linear-oblong, or linear-oblanceolate, subacute l., and solitary, large blue fl., on peduncles $\frac{1}{4}$–$1\frac{1}{2}$ in. long, with a pair of leaf-like bracts at the base of the acutely 5-toothed calyx. Alps.

Gentiana Gaudiniana, Thomas. (*Jard.* 1888, p. 76.) H. per., similar to *G. purpurea*, but usually more robust, and the calyx is entire, with about one lobe, not spathaceous; the corolla is of a somewhat lurid purple, with more pointed lobes than in G. purpurea. Alps, Switzerland. [According to Reichenbach, *G. Gaudiniana* is a synonym of **G. spuria,** Lebert.—*N. E. B.*]

Gentiana Kochiana, Perr. and Song. (*W. G.* 1888, p. 181, f. 39.) H. alpine per. in the way of *G. acaulis*, with elliptic, obtuse radical l., and large solitary fl. on short peduncles, dark blue, marked with 5 blackish-green spots. Calyx with folds between the lobes. Corolla lobes short, and scarcely spreading. Alps.

Gentiana Kummeriana, Sendt. (*Jard.* 1888, p. 76.) A hybid between *G. lutea* and *G. pannonica.* North Tyrol. Syn. *G. Haengsti*, Hausm. [No further information given, and I am unable to find where it is described.—*N. E. B.*]

Gentiana prostrata, Haenke. (*Jard.* 1888, p. 125.) H. annual. A small species 1–3 in. high, with small elliptic l., and solitary blue fl. about $\frac{1}{4}$ in. in diam., calyx 5-toothed. Carinthian Alps, Siberia, N. America.

Gentiana Thomasii, Gill. (*Jard.* 1888, p. 76.) This is another name for **G. rubra Clairv.** It is very similar to *G. lutea* in appearance, but the corolla has no folds, is purplish outside, and the tube is about equal to the lobes. Alps, Switzerland.

Gingko biloba, var. **pyramidalis.** (*W. G.* 1888, p. 214.) Coniferæ. Garden variety.

Gladiolus vinulus, Klatt. (*W. G.* 1888, p. 326 and 383.) Iridaceæ. G. bulb. A small-flowered species, with creamy-white fl., feathered with crimson. S. Africa.

Godetia pumila, var. **hybrida.** (*W. G.* 1888, p. 436.) Onagrariaceæ. Garden variety.

Grewia parviflora, Bunge. (*G. and F.*, 1888, v. 1, p. 297.) Tiliaceæ. H. shr. of botanical interest, 2–3 ft. high, with large, unequally serrate l., with 3 prominent veins, hispidulous above, whitish beneath. Fl. small, yellow, in dense, pedunculate umbels, hidden by the l. North China.

Gundelia Tournefortii, L. (*R. H.*, 1888, p. 53, f. 12; *G. and F.*, 1888, v. 1, p. 233; *and W. G.*, 1888, p. 391.) Compositæ. H. H. per. A stout thistle-like plant, with pinnatifid, spiny, bright green l., veined with white; and globose spiny heads of small chocolate and yellow fl., surrounded by an involucre of leaf-like bracts. Algeria, Persia, Afghanistan.

Gymnogramme Pearcei, var. **robusta,** Linden. (*G. and F.* 1888, v. 1, p. 303; *Veitch Cat.* 1888, p. 11; and *L'Hort. Int. Cat.* 1888–9, p. 50.) Filices. S. Fern. A robust form, with rather large, triangular, slightly cut pinnules, and having the base of the stipes covered with a white powder. South America.

Harpalium rigidum, var. **semiplenum,** Baker. (*G. C.* 1888, v. 4, p. 417.) Compositæ. H. herbaceous per. A variety, with 2, 3, or more rows of ray florets. Garden variety.

Heliconia choconiana, S. Wats. (*G. and F.* 1888, v. 1, p. 161–2, f. 31; and *R. H.* 1888, p. 290.) Scitamineæ. S. per. 3–4 ft. high, quite glabrous. L. sessile on the sheaths, 6–10 in. long, 2 in. broad, oblong - lanceolate acuminate, shining green. Infl. sessile, terminal, deflexed. Spathes scarlet, 2 in. long. Fl. yellowish, as long as the spathes. Guatemala.

Helichrysum devium, Johnson. (*G. C.* 1888, v. 4, p. 62.) Compositæ. G. shr. 2–3 ft. high, bushy, with snowy-white tomentose branches. L. lanceolate, sessile, 3-nerved, greyish-green, with white wavy borders. Peduncles white. Cymes of several fl. heads, with opaque white involucres and black disks. Madeira. N.B.—The above may not be in cultivation.

Heracleum persicum. (*W. G.* 1888, p. 273.) Umbelliferæ. H. per. A gigantic species growing 12–13 ft. high, with large umbels of white fl. Persia.

Hesperochiron pumilus, Port. (*Gfl.* 1888, p. 32.) Hydrophyllaceæ. H. alpine per., with tuberous rootstock. L. all radical 2–$2\frac{1}{4}$ in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad, spathulate, hairy beneath. Scapes naked, 1-flowered, fl. nearly rotate, white, veined with violet and with a yellow base, the lobes longer than the tube, which is hairy within. Idaho to Oregon, N. America.

Hibiscus lasiocarpus, Cav. (*G. and F.* 1888, v. 1, p. 425, f. 68.) Malvaceæ. H. H. shr. very similar to *H. moscheutos,* with broadly ovate l. more or less cordate at the base, nearly equally tomentose on both sides. Bracts of the involucre ciliate. Fl. as in *H. moscheutos.* Capsule more or less densely hairy. N. America. The form figured at the above place is the var. **occidentalis,** Gray, from Chihuahua and California, which differs in having the l. more uniformly cordate at the base, and the capsule pubescent rather than hirsute.

Hibiscus rosa-sinensis, var. **fulgens.** (*The Garden* 1888, v. 33, p. 96, t. 634; *H. G.* 1888, p. 181.) Malvaceæ. Garden variety.

Holothrix Lindleyana, Rchb. f. (*G.C.* 1888, v. 3, p. 364, f. 55 and 56.) Orchideæ. A pretty little terrestrial orchid, with 2 or 3 ovate radical l. spreading on the ground, and a slender scape bearing a raceme of small white fl. The lip is 5-lobed, with an inrolled spur. South Africa.

Howea Belmoreana, Beccari. (*B. M.* t. 7018; *G. C.* 1888, v. 4, p. 415; and *H. G.* 1888, p. 553.) Palmæ. S. Palm. This is the plant known as *Kentia Belmoreana.* Lord Howe's Island.

Hydrangea radiata, Walt. (*G. and F.* 1888, v. 1, p. 296.) Saxifragaceæ. An older name for *H. nivea,* Michx.

Hymenocallis humilis, S. Wats. (*G. and F.* 1888, v. 1, p. 114, f. 23.) Amaryllidaceæ. G. A small species, with a few short linear l., and a solitary fl. about 3 in. in expanse, with very narrow, linear, greenish segments, and a white corona. Florida. It is not stated if this is in cultivation.

Hymenocallis Palmeri, S. Wats. (*G. and F.* 1888, v. 1, p. 138, f. 25.) G. Similar to H. humilis, but with a smaller bulb, longer l., and larger fl., with narrower and longer white segments. Florida. Not stated if in cultivation.

Hypericum Moserianum, Luquet. (*Jard.* 1888, p. 209; and *W. G.* 1888, p. 470.) Hypericaceæ. H. per. Garden hybrid.

Iberis contracta, var. **rosea,** Dammann. (*Gfl.* 1888, p. 399.) Cruciferæ. H. per. A variety, with rose coloured fl.

Idesia polycarpa, var. **crispa,** Carr. (*R. H.* 1888, p. 463, f. 112; and *H. G.* 1888, p. 554.) Bixaceæ. Garden variety.

Illicium verum, Hook. f. (*B. M.* t. 7005; *G. C.* 1888, v. 4, p. 15; *G. and F.* 1888, v. 1, p. 299; and *H. G.* 1888, p. 399.) Magnoliaceæ. S. shr. of economic value (the true Star Anise). L. lanceolate or oblanceolate, obtusely acuminate, glabrous. Fl. axillary, globose, on pedicels $\frac{1}{2}$ in. long, outer segments green, inner purple. China.

Imantophyllum. *See also* **Clivia.**

Imantophyllum atrosanguineum, Williams. (*Williams Cat.* 1888, p. 20, misspelled *Himantophyllum.*) A garden variety of **Clivia miniata.**

Iris albicans, Lange. (*W. G.* 1888, p. 325.) Iridaceæ. H. Similar in size and habit to *I. germanica,* with pure white fl., that are very fragrant. Cyprus.

Iris Barnumi, Baker and Foster. (*G. C.* 1888, v. 4, p. 182.) H. per. Rhizome slender, fleshy. L. 5–6 in a tuft, 6 in. long, linear, acute, slightly falcate. Scape $1\frac{1}{2}$–$5\frac{1}{2}$ in. long, 1-flowered. Falls cuneate-obovate, 2 in. long, 1 in. broad, reflexed at apex dark red-purple, with darker veins, the beard fluffy, the hairs yellow with purple tips. Standards roundish-obovate, connivent, crenate, red-purple, with darker veins, and very few hairs on the claws. Styles very spreading, brownish-yellow, with purple dots and mid line, and purple crests. Armenia.

Iris benacensis, Kern. (*Verhandl. Zoolog.-Bot. Gesellsch. Wien.* 1887, p. 649.) H. 12–15 in. high. L. ensiform. Fl. mostly in threes, the lowest placed about the middle of the stem, the rest crowded at the apex. Falls elongate-obovate, dark violet, with darker veins, the claw whitish veined with coppery violet, the beard white at the base, yellow above. Standards broad, oblong, subemarginate, violet. Crests of stigma triangular, violaceous. Ovary oblong-cylindric. Tyrol.

Iris bracteata, S. Watson. (*G. and F.* 1888, v. 1, p. 43.) H. A distinct and rather peculiar species. Rhizome slender. L. solitary, rigid, 1–2 ft. long, ½ in. broad, or less, striate, one side green, the other glaucous. Stem angled, shorter than the l., covered with imbricating, purplish, sheathing bracts, 2-flowered. Fl. large, nearly pure yellow, on the oblong-oblanceolate sep. veined with bluish-purple. Pet. erect, narrow lanceolate. Styles spreading, recurved, with long crests. Oregon.

Iris cypriana, Baker and Foster. (*G. C.* 1888, v. 4, p. 182.) H. per. Allied to *I pallida.* L. ensiform, glaucous. Spathe-valves boat-shaped, becoming more or less scarious during the flowering. Falls cuneate-obovate 4½ in. long, 2½ in. broad, reddish-lilac, with darker veins, bearded with orange-tipped hairs. Standards oblong 3½ in. long, by 2½ in. broad, light bluish-lilac, spotted with with reddish-brown on the claw. Styles pale lilac, the crests broadly triangular. Cyprus.

Iris Kæmpferi, var. **Schirnhoferi,** Sieb. (*W. G.* 1888, p. 137, t. 1.) A variety, with yellow fl. Japan.

Iris Kochii, Kern. (*Verhandl Zoolog.–Bot. Gesellsch. Wein.* 1887, p. 649.) H. 12–16 in. high. L. ensiform, subglaucous. Fl. mostly in fours, the lowest branch at about the middle of the stem. Falls cuneate-obovate, brilliant violet, the claws whitish, veined with coppery and bearded with yellow. Standards deep purple-violet with yellowish claws, veined with purple. Crests of stigma ovate-triangular violaceous. Istria.

Iris Korolkowi, var. **concolor,** Foster. (*G. C.* 1888, v. 4, p. 37.) H. A variety, with broader and more obtuse segments than the type, and the venation almost obscured by the general violet or purple colour.

—— Var. **Leichtliniana,** Foster. (*G. C.* 1888, v. 4, p. 37.) A handsome form, with creamy-white fl., marked with a blackish-purple blotch at the base of the falls.

—— Var. **nervosa** mentioned in *Gfl.* 1888, p. 463, is doubtless a typographic error for var. **venosa.**

—— Var. **venosa,** Foster. (*G. C.* 1888 v. 4, p. 37.) A variety, with greyish-lilac fl., distinctly veined with purple.

—— Var. **violacea,** Foster. (*G. C.* 1888, v. 4, p. 37.) A variety, with violet or puce-coloured fl., with darker veins.

Iris pabularia, Naud. (*R. H.* 1888, p. 338; and *W. G.* 1888, p. 477.) H. No description. Said to be a good forage plant. Kashmir. [Can this be **I. ensata,** Thunb? *N. E. B.*]

Iris stylosa, Desf. var. **lilacina,** Sprenger. (*W. G.* 1888, p. 92, f. 15, 3.) A variety with smaller fl. than the type, of a tender lilac colour, with less pronounced yellow spots, and crests of stigma very upright. Atlas.

—— Var. **marginata,** Spenger. (*W. G.* 1888, p. 93.) A peculiar variety having the violet fl. edged with white.

—— Var. **pavonia,** Sprenger. (*W. G.* 1888, p. 93.) A variety with a white radiating area at the base.

—— Var. **speciosa,** Sprenger. (*W. G.* 1888, p. 92, f. 15, 2; and *B. T. O.* 1888, p. 165.) A variety with smaller l., and larger, brightly-coloured fl. The falls are clear violet, with the basal part whitish veined with violet-purple; the standards are brownish-purple. Stated to be only adapted for pot culture.

Iris tenuis, S. Wats. (*G. and F.* 1888, v. 1, p. 6, f. 3.) H. A distinct Iris, with very slender creeping rhizome, thin ensiform l., ¼–½ in. broad, and a very slender 2–3 flowered stem 10–12 in. high. Fl. distant in slender peduncles 1–2½ in. long, leaf-like. Spathes small, scarious. Fl. small, white, marked with yellow and purple. Falls oblong-spathulate spreading. Standards narrow, oblong, erect. Oregon.

Iris trojana, Kern. (*Verhandl. Zoolog.—Bot. Gesellsch. Wein.* 1887, p. 650.) H. ? A tall growing species, attaining 3 ft. in height. L. ensiform, glaucescent, acute. Fl. stem with several branches, the lower 3-flowered, the upper 2-flowered. Falls broadly cuneate-obovate, reflexed, brilliant purple-violet, the claws whitish, with yellowish margins veined with coppery-purple. Standards broadly elliptic, emarginate, violet. Crests of stigma, broad, toothed, porrect bluish-violet. Fl. sweet scented. Troy.

Kæmpferia secunda, Wall. (*B. M.* t. 6999; *G. C.* 1888, v. 3, p. 722; *Garden,* v. 4, p. 154, with plate; and *H. G.* 1888, p. 369.) Scitamineæ. S. per herb, 6–10 in. high. Stems slender, with 5 or 6 lanceolate acuminate green

l. Spike terminal, few flowered. Fl. an in. in diam., bright purple, with a white spot at the base of the two upper segments, and a white stripe down the centre of the roundish, bilobed lip. Assam.

Kalmia latifolia, var. **Pavarti,** André. (*R. H.* 1888, p. 540, with pl.) Ericaceæ. Garden variety.

Karatas antiacantha. (*G. C.* 1888, v. 4, p. 474.) Bromeliaceæ. Something in the way of *K. Legrellæ*, but larger. The leaves are brownish at the base, and the bracts of a deeper scarlet. [Probably the plant intended is *Bromelia antiacantha*, Bert., which is a syn. of **B. fastuosa,** Lindl.—*N. E. B.*]

Kennedya ovata. var. **cærulea,** Heede. (*Jard.* 1888, p. 93.) Leguminosæ. G. A variety with blue fl. Australia. [*K. ovata* is a synonym of **Hardenbergia monophylla,** Bth. —*N. E. B.*]

Kentia elegantissima, (*L'Hort. Int. Cat.* 1888–9, p. 43.) Palmæ. No description or locality given, but possibly a species of **Howea.**

Kœlreuteria bipinnata, Franch. (*R. H.* 1888, p. 393, f. 93; *B. T. O.* 1888, p. 307; *G. and F.* 1888, v. 1, p. 376; *Jard.* 1888, p. 59; and *W. G.* 1888, p. 124.) Sapindaceæ. H. tree of ornamental character, free flowering. L. bipinnate 2 ft. or more long, and nearly as broad; pinnæ few, each with 9 or 10 ovate, acute, toothed leaflets. Fl. resembling those of *K. paniculata*, disposed in large panicles, bright yellow, with a purple spot at the base of the pet. Fr. broadly elliptic, 2½ in. long, purple when ripe. Yunnan, China.

Korolkowia discolor, Regel. (*G. C.* 1888, v. 3, p. 105; *H. G.* 1888, p. 128; and see *Gfl.* 1886, p. 349.) Liliaceæ. H. bulb. This seems to be the same as **Fritillaria Sewerzowi** var. **bicolor.**

Lælia anceps, var. **Amesianum,** Sander. (*G. C.* 1888, v. 4, p. 660.) Orchidæ. A fine variety, with white sep. and pet. of firm substance; the sep. have an emerald-green dot at their apex, and the pet. are feathered with crimson at the tips. Lip rich violet-crimson, with the tube yellow inside, streaked with purple, white outside, and a central, 3-ridged, orange keel.

Lælia anceps, var. **radians,** Rchb. f. (*G. C.* 1888, v. 3, p. 200; *H. G.* 1888, p. 179; and *O.* 1888, p. 355.) Sep. and pet. deep purple with a white basal area. Lip very dark purple, with the disk of the side lobes dark orange, and a few dark purple lines.

Lælia anceps, var. **Scottiana,** Williams and Warn. (*W. O. A.* v. 7, pl. 325.) A handsome variety with rich mauve sep. and pet. and a dark purple lip with a yellow throat. Mexico.

Lælia Gouldiana, Rchb. f. (*G. C.* v. 3, p. 41; *G. and F.* 1888, v. 1, p. 4; *O.* 1888, p. 100; and *R.* v. 2, p. 23, t. 59.) A handsome plant, allied to *L. autumnalis* and *L. Crawshayana* with fusiform, 2-leaved bulbs, cuneate-oblong l. nearly a ft. long, and fl. as large as those of *L. autumnalis.* Sep. and pet. broad, acuminate, warm purple. Lip with long white side lobes edged with light purple, and a cuneate-obovate, retuse middle lobe, dark purple, white at the base, veined and spotted with darker purple, and with 3 yellow keels on the disk.

Lælia Horniana, Rchb. f. (*G. C.* 1888, v. 3, p. 770; *H. G.* 1888, p. 371; and *L.* v. 4, p. 8.) Garden hybrid.

Lælia pachystele, Rchb. f. (*G. C.* 1888, v. 4, p. 596.) Fl. as large as those of *L. elegans.* Sep., and the broader wavy pet. light rose. Lip very narrow; side lobes long and narrow, white, with light purple borders; front lobe narrow, oblong, acute, rose, with darker purple veins.

Lælia Perrinii, var. **alba,** O'Brien. (*G. C.* 1888, v. 4, pp. 446 and 565.) A white-flowered variety with a tinge of yellow on the disk of the lip.

Lælia porphyritis (*Revue de l'Horticulture Belge*, Feb. 1888; *G. C.* 1888, v. 3, p. 235.) Resembling *L. pumila* with oblong-acute sep. and pet. of a dull purplish colour, the lip with the basal ⅔ rolled around the column, and a roundish, rich carmine terminal lobe.

Lælia purpurata, var. **blenheimense,** Williams and Warn. (*W. O. A.* v. 8, pl. 346.) A handsome variety with blush-rose sep. streaked with rosy-purple, deep rosy-purple pet, veined with darker, and a very dark purple lip, with a deep yellow throat veined with dark purple, and the apex rosy purple veined with dark purple. South Brazil.

Lælia purpurata, var. **Whiteana,** Rchb. f. (*G. C.* 1888, v. 3, p. 681; and *H. G.* 1888, p. 370.) A variety with a dark purple lip, without yellow in the throat.

Lælia elegans, var. **Morreniana,** Rchb. f. (*W. O. A.* v. 7, pl. 331; and *G. C.* 1888, v. 3, p. 800.) A grand variety with magenta-rose sep. and pet., and the front part of the lip rich magentacrimson, margined with lilac. Brazil.

Lælia elegans, var. **nyleptha,** O'Brien. (*G. C.* 1888, v. 3, p. 178, with pl.) A variety with large fl. 7 in. broad, faintly tinged with rose at first, changing to sulphur-yellow, the lip with a white tube, and the front lobe and tips of the side lobes crimson.

Lælia elegans, var. **Tautziana,** Rchb. f. (*G. C.* 1888, v. 3, p. 330; *H. G.* 1888, p. 227; *L.* v. 3, p. 66; and *O.* 1888, p. 295.) A large-flowered form with broad, light purple sep. and broad, cuneate-obovate; dark purple pet. Lip with white side lobes tipped with purple, and a sessile dark purple front lobe. Bulbs stout, and l. very broad and thick.

Lælia euterpe, Rolfe. (*G. C.* 1888, v. 4, p. 533.) Garden hybrid.

Lælia Eyermaniana, Rchb. f. (*G. C.* 1888, v. 4, p. 91 and 109, f. 12; *G. and F.* 1888, v. 1, p. 315; and *H. G.* 1888, p. 398.) A curious species, with a raceme of 3–4 rosy-purple fl. about 2 in. in diam. Sep. and pet. oblong, blunt. Lip 3-lobed, the front lobe wavy; disk with 3 yellow keels.

Lælia superbiens, var. **decorata,** Rchb. f. (*G. C.* 1888, v. 3, p. 200; *H. G.* 1888, p. 179; and *O.* 1888, p. 325.) A form with very narrow sep. and pet., and a very dark purple lip, with the side lobes covered by a very close, dark purple network of veins.

Lælia Timora, N. E. Br. (*G. C.* 1887, v. 2, p. 428; and *O.* 1888, p. 265.) Garden hybrid.

Lælia Tresederiana, Rchb. f. (*G. C.* 1888, v. 3, p. 136; *H. G.* 1888, p. 176; and *O.* 1888, p. 198.) Garden hybrid.

Lælia xanthina, var. **agraphis,** Rchb. f. (*G. C.* 1888, v. 4, p. 264; and *H. G.* 1888, p. 503.) A variety without purple markings on the lip.

Læliocattleya bella, Rolfe. (*G. C.* 1888, v. 3, p. 361; and *H. G.* 1888, p. 229.) Orchideæ. A synonym of **Lælia bella,** Rchb. f.

Lathyrus Sibthorpi. (*W. G.* 1888, p. 326 and 383.) Leguminosæ. H. A handsome plant with magenta-red fl.; no further description. Greece.

Leontice darwasica, Regel. (*G. C.* 1888, v. 3, p. 200; and *H. G.* 1888, p. 179.) Berberidaceæ. H. tuber with glaucous l., those on the stem trifoliolate, leaflets roundish or elliptic, fl. yellow, ¾–1 in. diam. Bokhara.

Lilium Grayi, S. Watson. (*G. and F.* 1888, v. 1, p. 19, f. 4, and p. 56; and *W. G.* 1888, p. 202.) Liliaceæ. H. Allied to *L. canadense*, but with smaller and less drooping fl., with broader segments that are not recurved. L. 4–8 in a whorl, lanceolate acute, not at all scabrous. Fl. often solitary, ascending or somewhat nodding, sub-campanulate, 1½–2 in. long, the segments oblanceolate, abruptly acute, not re-curved, deep reddish-orange, spotted within. Alleghany Mountains.

Lilium Henryi, Baker. (*G. C.* 1888, v. 4, p. 660.) Liliaceæ. Described at the above place, but not yet in cultivation; is a fine lily, 2–3 ft. high, with close-set lanceolate l. 6–8 in. long, and a large lax corymb of 4–8 fl., 3–3½ in. long, yellow, dotted in the lower part with red-brown. Ichang.

Lindelofia longifolia. (*W. G.* 1888, p. 326.) Boragineæ. H. per. An ornamental herbaceous plant, 2–2½ ft. high, with lanceolate l. and scorpioid cymes of bright blue Forget-me-not like fl. [Is not this an error for **L. spectabilis,** Lehm.? which is the *Cynoglossum longiflorum*, Royle, figured in the *Botanical Register*, 1840, p. 50. —*N. E. B.*]

Liparis minutiflora. (*G. C.* 1888, v. 3, p. 75.) Orchideæ. [This is a provisional name given to a plant at Kew that was afterwards found to be **L. spathulata,** Lindl.—*N. E. B.*] It is an unattractive species of tufted habit, with bulbs 1½ in. long, l. 3–6 in. long, and racemes of minute pale green fl.

Lissochilus giganteus, Welw. (*G. C.* 1888, v. 3, p. 616–7, f. 83, and v. 4, p. 353; *H. G.*, 1888, pp. 309, 400; *Ill. H.* v. 35, p. 49, pl. 53; and *O.* 1888, p. 267.) Orchideæ. See **Eulophia gigantea.**

Lonicera flavescens, Dippel. (*Gfl.* 1888, p. 7, f. 1.) Caprifoliaceæ. H. shr. with petiolate, lanceolate acuminate l. Bracts ovate acute; bracteoles connate, covering the base of the corolla. Fl. varying from sulphur-yellow to citron-yellow, glandular-hairy, segments of corolla nearly regular. Syn. *L. Webbiana* of some gardens. British Columbia.

Lonicera Webbiana, of gardens. See *L. flavescens*, Dipp.

Lonicera Webbiana, Wall. (*Gfl.* 1888, pp. 7 and 8, f. 2.) H. shr. very like *L. alpigena*, and perhaps only a form of that species. L. large oblong or elliptic-oblong, somewhat abruptly pointed. Corolla 2-lipped, yellowish-green, suffused outside with brownish-red. Himalayas.

Lourya paniculata, Baillon. (*R. H.* 1888, p. 315.) Liliaceæ. S. No description given, but said to be intermediate in character between Liliaceæ and Amaryllidaceæ. Cambodia.

Lycaste macropogon, Rchb. f. (*G. C.* 1888, v. 3, p. 200; *H. G.* 1878, p. 179; and *O.* 1888, p. 357.) Orchideæ. Allied to *L. macrobulbon*, but with larger orange-coloured fl. Sep. oblong acute, hairy at the base; pet. smaller; lip three-lobed; front lobe cuneate oblong, acute, hairy, with a broad rhomboid tubercle at its base. Costa Rica.

Lycium pallidum, Miers. (*G. and F.* 1888, v. 1, p. 340, f. 54.) Solanaceæ. H. shr. something in the way of *L. vulgare*. Branches somewhat drooping, with a few long, slender spines. L. oblanceolate, 1–2 in. long, very pale. Fl. solitary or in pairs, axillary pedicellate; corolla ¾ in. long, tubular-funnel-shaped, with broad, rounded, spreading lobes, green or tinged with purple. Berries bright red, nearly ½ in. long. New Mexico, Arizona.

Lycoris sanguinea, Maxim. (*B. T. O.* 1888, p. 328.) Amaryllidaceæ. H. bulb, with 3–7 linear, obtuse l., ⅙ in. broad, and a slender scape 1–1½ ft. long, bearing an umbel of 4–6 erect carmine fl. 1½–3 in. long, with erect segments which are not crisped or undulate. Japan.

Lycoris squamigera, Maxim. (*B. T. O.* 1888, p. 327.) H. bulb, with 5–6 l., a ft. or more long, and ¾ to 1 in. broad. Scape stout, 2–3 ft. long, with an umbel of 4–7 rose-coloured fl. about 3 in. long, with shorter stamens than in *L. aurea*. Japan.

Macaranga Porteana, André. (*R. H.* 1888, p. 176, f. 36; and *G. and F.* 1888, v. 1, p. 168.) Euphorbiaceæ. S. tree of bold habit. L. peltate a ft. and a half long and nearly as broad, roundish-ovate acute; margin ciliate-toothed, wavy, upper surface with a sparse cobwebby pubescence, under side black-dotted, veins very prominent, pubescent or setulose beneath. Petioles 20–24 in. long, with large ovate-lanceolate acuminate stipules. Syn. *Mappa Porteana*, André. Philippines.

Macrotomia Benthami, D.C. (*B. M.* t. 7003; *G. C.* 1888, v. 4, p. 15; *G. and F.* 1888, v. 1, p. 299; and *H. G.* 1888, p. 398.) Boragineæ, G. or H. H. herbaceous per, 1–3 ft. high, roughly hairy. Radical l. 6–15 in. long, narrowly lanceolate, 5–7 ribbed. Stem l. smaller. Fl. in a dense leafy spike 6–12 in. long, by 2–2½ in. thick. Calyx-lobes about an in. long, linear. Corolla shorter than the calyx-lobes, tubular funnel-shaped, with short spreading lobes, dark brownish purple. N. W. Himalaya.

Magnolia parviflora, and var. **minor.** (*W. G.* 1888, p. 288.) Magnoliaceæ. H. A form that is smaller in all its parts. Japan.

Mappa Porteana, André. (*R. H.* 1888, p. 176.) See **Macaranga Porteana.**

Masdevallia culex, of Gardens. (*G. C.* 1888, v. 3, p. 361, 404, and 488.) Orchideæ. This is shown to be the same as **Pleurothallis macroblepharis,** Rchb. f. at the above-quoted place.

Masdevallia cupularis, Rchb. f. (*G. C.* 1888, v. 3, p. 233; *H. G.* 1888, p. 180; and *O.* 1888, p. 162.) L. small, oblong, obtuse, shining. Fl. about 2 in. long, the cup-shaped part light brown densely spotted with darker brown, glossy, inside very dark brown, pet. and lip ochreous, the lip with 3 brown lines on the front lobe, and numerous spots on the side lobes. Costa Rica.

Masdevallia Harryana, var. **decora.** Williams and Warner. (*W. O. A.* v. 8, pl. 344.) A var. with light rosy purple fl., faintly nerved with darker, and with crimson tips. Columbia.

Masdevallia Hubschii. (*L.* v. 4, p. 8.) [A mistake for **Maxillaria Hubschii.** Rchb. f.—*N.E.B.*]

Masdevallia platyrhachis, Rolfe. (*G. C.* 1888, v. 4, pp. 178 and 628.) A distinct and remarkable species, with oblanceolate-oblong l., 2–6 in. long, ¾–1 in. broad, and a flattened scape bearing a raceme of light buff coloured fl., with green nerves and orange bases to the side sep. The sep. are scarcely combined in a tube at the base, and are verrucose inside. Pet. linear, brown. Lip 3-lobed, acute, 2-keeled, light yellowish-brown. Costa Rica.

Masdevallia punctata, Rolfe. (*G. C.* 1888, v. 4, p. 323; and *H. G.* 1888, p. 505.) Allied to *M. swertiæfolia*. Tufted, l. 3–4 in. long, ½–¾ in. broad. Scape descending, bearing a succession of small pale greenish fl., spotted with dark purple brown, the spots more or less suffused together at the base of the fl.; the side sep. are more ochreous than the rest of the fl., and the spots minute. Tails of side sep. 1½ in. long, of upper sep. ¼ in. long.

Matricaria eximia grandiflora aurea, Carr. (*R. H.* 1888, p. 163.) Compositæ. H. Garden variety.

Maxillaria fuscata. (*G. C.* 1888, v. 4, p. 576–7, f. 81.) Orchideæ. A misprint for **M. fucata,** Rchb. f. noted in *Kew Bulletin* for 1888, p. 109.

Maxillaria Hubschii, Rchb. f. (*G. C.* 1888, v. 3, p. 136; *H. G.* 1888, p. 176; *O.* 1888, p. 193 and *L.* v. 4, p.

8, as *Masdevallia Hubschii,*) Orchideæ. Allied to *M. fucata*, which it resembles in appearance. Fl. white; lateral sep. rounded, pet. linear-rhombic acute, lip transverse, rhombic, with a transverse, emarginate, yellow tubercle on the disk, and some hairs behind it, the margin inside is mauve-purple, and there are some spots of the same colour outside at the base.

Medinilla magnifica, var. **rubra.** (*W. G.* 1888, p. 155.) Melastomaceæ. S. shr. A fine variety, with darker coloured fl.

Megaclinium oxyodon, Rchb. f. (*G. C.* 1888, v. 4, p. 91; and *H. G.* 1888, p. 398.) Orchideæ. A small plant with a creeping rhizome; spherical, 4-angled, dark green, punctate, wrinkled bulbs, bearing 2 lanceolate acute l. 2 in. long. $\frac{1}{2}$ in broad; and a flat peduncle $\frac{1}{3}$ in. broad, of a light green colour. Fl. like those of *M. falcatum*, but pet. longer and more arched; lip membranous, 3-lobed. Syn. *Bulbophyllum oxyodon*, Rchb. f. Madagascar.

Megaclinium scaberulum, Rolfe. (*G. C.* 1888, v. 4, p. 6; and *H. G.* 1888, p. 397.) A small plant with creeping rhizomes, tetragonal bulbs bearing 2 elliptic-oblong l., 2 in. or more long, and an erect infl. 3–4 in. long, the fl.-bearing part of the peduncle being flat and about $\frac{1}{4}$ in. broad, densely spotted and marbled with dusky purple, and bearing several fl. on each side, of a dull purple colour with the base of the sep. whitish-green spotted with purple, outside roughish. Pondoland.

Menziesia glabella, A. Gr. (*H. G.* 1888, p. 559.) Ericaceæ. H. shr., very similar to *M. globularis*, Saisb; but the filaments are ciliate, and the seeds have appendages at each end. L. lanceolate, obtuse, glaucescent and nearly or quite glabrous beneath, sparsely hairy above, ciliolate. Fl. in terminal umbels, corolla ovoid-campanulate lurid-purple. Rocky Mountains.

Merendera caucasica, var. **ruthenica,** Max Leichtlin. (*G. and F.* 1888, v. 1, p. 138.) Liliaceæ. H. bulb, flowering before the narrow l. appear. Fl. crocus-like, bright carmine-purple. Transylvania. [N.B.—This is probably **Bulbocodium ruthenicum,** Bunge, which is the same as *B. vernum*, var. *versicolor*, Baker. *N. E. B.*]

Mesembryanthemum Brownii, Hook f. (*B. M.* t. 6985; *G. C.* 1888, v. 3, p. 305; *H. G.* 1888, p. 230; and *R. H.* 1888, p. 480.) Ficoideæ. G. Succulent. A very showy species, allied to *M. polyanthon*, and equally free flowering. Stems erect, much branched. L. $\frac{1}{2}$–$\frac{2}{3}$ in. long subterete, in distant pairs, glaucous green. Fl. terminal, an inch in diam. of a brilliant orange red, or purple. South Africa.

Momordica martinicensis, D. (*W. G.* 1888, p. 473.) Cucurbitaceæ. S. annual, resembling *M. Charantia*. L. Very quick growing, much branched, with ornamental fr.

Muehlenbeckia depressa, Meissn. (*B. T. O.* 1888, p. 249.) Polygonaceæ. A misprint for **M. adpressa,** Meissn. It appears to be known in some gardens as *Philopodium rigidum*.

Musa Fehi, Bert. (*R. H.* 1888, p. 70.) S. Banana 15–20 ft. high. The stem is green with violaceous bands, and filled with an abundant violet-coloured juice. L. very large and strongly nerved. Tahiti.

Mussænda erythrophylla, Sch. and Thonn. (*Bull Cat.* 1888, p. 8, and p. 5 with fig.; *L'Hort. Int. Cat.* 1888–9, p. 51, and *W. G.* 1888, p. 330.) Rubiaceæ. S. A handsome shr., hairy in all parts. L. opposite, broadly elliptic, acute, petiolate. Fl. in terminal cymes, with large elliptic crimson bracts. Corolla an in. long, sulphur-yellow. Tropical Africa.

Narcissus Broussonetii, Lagasca. (*G. C.* 1888, v. 3, p. 169, 207, and v. 4, p. 300.) Amaryllidaceæ. An interesting species, with twisted, pale glaucous green l. 1$\frac{1}{2}$–2 ft. long, $\frac{1}{2}$ in. broad, and an umbel of 6–9 pure white fl., $\frac{3}{4}$–1 in. in diam., very sweetly scented, remarkable for the corona being absent or very rudimentary. Morocco.

Narcissus scaberulus, Henriques. (*G. C.* 1888, v. 4, p. 296.) H. bulb. Allied to *N. rupicola*. Bulb small. L. 2., more or less prostrate, linear, 2-angled beneath, glaucous with rough edges and keels. Scape 2$\frac{1}{2}$–4 in. high, 1–2 flowered. Fl. small, yellow, with a cup-shaped corona, and 3 exserted stamens. Portugal.

Nepenthes Dicksoniana, Mart. (*G. C.* 1888, v. 4, pp. 543 and 541, f. 78.) Nepenthaceæ. Garden hybrid.

Nepenthes excelsior. (*L'Hort. Int. Cat.* 1888–9, p. 51.) Garden hybrid.

Nepenthes rufescens, Veitch. (*G. C.* 1888, v. 4, p. 669, f. 95.) Garden hybrid.

Nicotiana colossea, André. (*R. H.* 1888, p. 511.) Solanaceæ. H. H. or G. annual, with a stout simple stem 7–10 ft. high. L. very large, a yard long, by 20–22 in. broad, dark shining green, tinted with reddish violet when young. Ovate acute, attenuate at the base into large wavy wings on the stout petiole. Fl. unknown. Brazil.

Nidularium striatum, Bull. (*Bull Cat.* 1888, p. 8, and 6 with fig.; *L'Hort. Internat. Cat.* 1888–9, p. 51; and *W. G.* 1888, p. 329.) Bromeliaceæ. A very ornamental plant, with a rosette of spreading broad l. 8–12 in. long, green, striped with white and creamy-yellow, the margins spinulose.

Notholæna (Nothoclæna) Muelleri. (*G. and F.* 1888, v. 1, p. 316.) Filices. S. Fern, with slender fronds a ft. long, having rounded, olive-green pinnæ, covered with brownish scales.

Nymphæna Casparyi, var. **alba,** Carr. (*R. H.* 1888, p. 300.) Nymphæaceæ. A synonym of **N. alba.**

Nymphæa Marliacea. (*G. C.* 1888, v. 3, p. 564; *Garden*, v. 33, p. 292, with plate; and *H. G.* 1888, p. 231.) H. Water-lily with canary-yellow fl. [Is the same as **N. tuberosa,** var. **flavescens,** Oliv.—*N. E. B.*]

Nymphæa Ortgiesiana, var. **Adele, N. scutifolia,** var. **rosea;** and **N. zanzibarensis,** var. **flore rubro.** (*G. C.* 1888, v. 3, p. 800.) These Water-lilies are stated by Mr. Watson at the place quoted, to be indistinguishable from each other, and to be the same as **N. stellata,** var. **purpurea.**

Nymphæa voalefoka, Marliac. (*G. C.* 1888, v. 4, p. 236.) S. aquatic. This is said to be a white variety of **N. stellata.** Madagascar?

Odontoglossum Andersonianum, lobatum, var. **Lemoinierianum,** Rchb. f. (*G. C.* 1888, v. 4, p. 378; and *H. G.* 1888, p. 549.) Orchideæ. A variety with large fl. Sep. and pet. bordered with yellow. Lip without a border, yellow at the base.

Odontoglossum Andersonianum and var. **lobatum, O. Jenningsianum,** and vars. **limbosum** and **pauciguttatum, O. Ruckerianum, O. baphicanthum, O. hebriacum,** and vars. **lineoligerum** and **aspersum, O. brassia, O. deltoglossum,** and **O. Leeainum** are referred as forms of **O. lanceans** in Reichenbachia t. 37. (*G. C.* 1888, v. 3, p. 203.)

Odontoglossum Boddærtianum, Rchb. f. (*G. C.* 1888, v. 3, p. 296; *L'Hort. Int. Cat.* 1888–9, p. 44; *H. G.* 1888, p. 227; *L.* v. 3, p. 64; and *O.* 1888, p. 321.) Allied to *O. odoratum.* Sep. and pet. lanceolate-acuminate, yellow marked with brown. Lip white, spotted with purple on the semi-oblong, upright basal lobes, front lobe with small spreading basal angles, lanceolate-acuminate, slightly toothletted; crest of two parallel 2 toothed tubercles at the base, with a few purple spots around it. Venezuela.

Odontoglossum citrosmum, var. **Devansayeanum,** Lind. (*L.* v. 3, p. 85, pl. 137.) A white flowered var. dotted on the sep. and pet. with reddish. [Seems scarcely distinct from var. **album,** Veitch.—*N. E. B.*]

Odontoglossum constrictum, var. **castaneum,** Rodigas. (*Ill. H.* 1888, v. 35, p. 83, pl. 66.) A variety with chocolate-brown sep. and pet., margined with yellow.

—— var. **majus,** Rodigas. (*Ill. H.* 1888, v. 35, p. 83.) A form with longer fl., and the base of the lip hastate. Venezuela.

Odontoglossum crispum, var. **Gouvilleanum,** André. (*R. H.* 1888, p. 132 with pl.) A variety with large white fl., having large brown blotches on the sep. and a spot or two on the pet.

Odontoglossum crispum, var. **Kinlesideanum,** Rchb. f. (*R.* v. 1, p. 103, pl. 45; and *G. C.* 1888, v. 3, p. 689.) A remarkable form with three series of crest-like teeth on the face of the pet. Sep. and pet. rosy-white, the pet. streaked with red over their central area. Lip white with a yellow disk and some red spots around it, and radiating lines at the base.

O. crispum, var. **latimaculatum,** Linden. (*L.* v. 4, p. 5. pl. 145.) A variety with broad white sep. and pet., and a broad chocolate spot on the lip. Syn. *O. latimaculatum*, Linden.

Odontoglossum cuspidatum, var. **platyglossum,** Rchb. f. (*G. C.* 1888, v. 4, p. 91; and *H. G.* 1888, p. 398.) **O. cuspidatum** is allied to *O. luteopurpureum,* but the pet. are very acuminate, not edged, and the narrow lip is abruptly cuspidate at the apex. The sep. and pet. are dark brown, with very little yellow. The variety **platyglossum** has a broad lip. Columbia.

Odontoglossum dicranophorum, Rchb. f. (*G. C.* 1888, v. 3, p. 330; *H. G.* 1888, p. 228; and *O.* 1888, p. 357.) Raceme lax. Fl. as large as that of *O. triumphans* but with narrower segments. Sep. linear acute, yellow, with 2 large brown spots. Pet. broadest at the base, acuminate, yellow, with one large and some small brown spots. Lip oblong, elliptic at the base, front lobe linear acute, from the base to the centre is a broad depressed crest ending in two thick blades, light yellow, with a brown spot on the front lobe.

Odontoglossum excellens, var. **chrysomelanum**, Rchb. f. (*G. C.* 1888, v. 3, p. 522; and *H. G.* 1888, p. 281.) A variety with yellow fl. spotted all over.

Odontoglossum elegantius, Rchb. f. (*G. C.* 1888, v. 3, p. 200; and *H. G.* 1888, p. 179.) Near *O. Kalbreyeri*. Sep. and pet. lanceolate, acute, pale yellow marked with brown. Lip pale yellow, side lobes rectangular, middle lobe cuneate-oblong, apiculate, with a long crest between the side lobes and with two diverging, emarginate shanks at the base of the mid lobe. Ocana.

Odontoglossum Glonerianum, Linden. (*L.* v. 4, p. 17, pl. 151; and *H. G.* 1888, p. 556.) See **O. odoratum** var. **Glonerianum.**

Odontoglossum Hrubyanum, Rchb. f. (*G. C.* 1888, v. 4, p. 234; and *H. G.* 1888, p. 502.) Fl. in a lax raceme. Sep. and pet. cuneate-lanceolate, brown with the tips, and the bases of the side sep. yellow. Lip pandurate sub-acute, denticulate in front, yellowish, with a brown blotch in front of the white crest, which is 2-toothed in front, with an apiculus and a tumour on each side at the base. Peru.

Odontoglossum latimaculatum, Linden. (*L.* v. 4, p. 5, pl. 145; and *H. G.* 1888, p. 501.) See **O. crispum** var. **latimaculatum**, Lind.

Odontoglossum maculatum, var. **Duvivierianum**, Rchb. f. (*G. C.* 1888, v. 4, p. 352; and *H. G.* 1888, p. 505.) A variety with lemon-yellow sep. and pet., and a whitish-yellow lip, all of which are spotted with brown.

Odontoglossum Masereelianum, Rchb. f. (*G.C.* 1888, v. 3, p. 618; and *H. G.* 1888, p. 310.) Natural hybrid.

Odontoglossum odoratum, var. **Glonerianum**, Linden. (*L.* v. 4, p. 17, pl. 151.) A large variety with numerous fl., the sep., pet., and lip all lanceolate acuminate, white, much spotted with purple-brown. Venezuela. Syn. *O. Glonerianum.*

Odontoglossum Rossi, var. **Amesianum**, Williams and Warner. (*W. O. A.* v. 8, pl. 343.) A variety with greenish-white sep., heavily spotted and barred with brown; pet. white, with a large brown area at the base; lip white with a yellow crest. Mexico.

Odontoglossum triumphans, var. **volubile**, Carr. (*R. H.* 1888, p. 179.) This differs from the type in having narrower and longer l., a twining fl.-stem 4½ ft. or more long, with smaller, distant fl., having narrower and more acuminate segments of a paler colour. Perhaps a distinct species. Ocana.

Oncidium chrysops, Rchb. f. (*G. C.* 1888, v. 3, p. 105; *H. G.* 1888, p. 128; and *O.* 1888, p. 194.) Orchideæ. Allied to *O. bicallosum*, with short reddish l., and a reddish racemose peduncle. Sep. and pet. light brown, the pet. broader and wavy. Lip yellow, the basal lobes small, the front lobe large, reniform, emarginate, with two large tubercles at the base, 3 very small thread-like tubercles in the middle, and 3 terete ones in front; column with falcate deflexed wings.

Oncidium chrysorhapis, Rchb. f. (*G. C.* 1888, v. 3, p. 72; *H. G.* 1888, p. 127; and *O.* 1888, p. 199.) Allied to *O. cornigera*. Bulbs 3–4 in. long, terete-fusiform. L. oblong-lanceolate, acute, 6–7 in. long, 1½ in. broad, glossy dark green. Sep. and pet. broad, pale yellow, nearly covered with dark brown spots on the disk, side sep. connate. Lip with erect, linear, side lobes, lobed at the apex; and a large reniform emarginate front lobe; the claw has numerous tubercles upon it. Brazil.

Oncidium crispum sublæve, var. **ochraceum**, Rchb. f. (*G. C.* 1888, v. 4, p. 756.) A form with ochre-brown fl., without lateral crests on the sides of the middle keel of the lip.

Oncidium detortum, Rchb. f. (*G. C.* 1888, v. 3, p. 392; and *H. G.* 1888, p. 229.) Something in the way of O. serratum, with a very long inflorescence. Sep. shortly clawed and eared, cuneate-oblong, acute, wavy, light brown, the upper one yellowish at the apex. Pet. with shorter claws, wavy, yellow with brown spots. Lip with spreading triangular side lobes, and an oblong, acute front lobe, the crest is formed of several keels and teeth.

Oncidium Jonesianum, var. **flavum**, Rchb. f. (*G. C.* 1888, v. 4, p. 234; *W. O. A.* v. 8, pl. 360; and *H. G.* 1888, p. 502, as var. *flavens*.) A variety with yellowish green spots on the sep. and pet., and yellowish lip and column.

Oncidium Kramerianum, var. **resplendens**, Rchb. f. (*G. C.* 1888, v. 3, p. 860; and *H. G.* 1888, p. 229.) A large, brightly coloured variety, with no brown margin to the wavy lip, which has a longer crest, white in the middle with purple-mauve and purple-brown spots and bars.

Oncidium Lietzei, var. **aureo-maculatum**, Regel. (*Gfl.* 1888, p. 441, t. 1279; and *H. G.* 1888, p. 462.) A variety with the fl. much spotted and barred with brown.

—— Var. **bicolor**, Regel. (*Gfl.* 1888, p. 441.) A small flowered form, with brown fl. variegated with yellow.

Oncidium maculatum, var. **psittacinum**, Rchb. f. (*G. C.* 1888, v. 4, p. 378; and *H. G.* 1888, p. 549.) A variety in which the sep. and pet. of the yellow fl. are much blotched.

Oncidium Mantini, God.-Leb. (*O.* 1888, p. 47 with pl.; *G. C.* 1888, v. 3, p. 235; and *R. H.* 1888, p. 98.) Something in the way of *O. Gardneri*. Bulbs ovoid, with two strap-shaped emarginate l. and a raceme of large fl. Upper sep. and the very large pet. chocolate-brown, with yellow borders spotted with chocolate-brown. Side sep. united at the base ?, chocolate-brown with yellow bars. Lip with a narrow oblong base, and a very large, reniform, lobulate front lobe, yellow spotted with bright reddish-brown. Brazil.

Oncidium murinum, Rchb. f. (*G. C.* 1888, v. 3, p. 619.) A pretty, but small flowered species, with a large panicle of numerous yellow fl., having the columns of a dull crimson-purple. Lip triangular, sessile, fleshy, with 2 roundish crests on the disk.

Oncidium orthotis, Rchb. f. (*Ill. H.* v. 35, p. 91, pl. 69.) A small but interesting species, with peculiarly shaped fl. Bulbs small, compressed, ovate, with one cuneate-oblong l. 1½–2 in. long. Fl.-stem about 9 in. long, with 5–6 branches, which terminate in a single fl. about ¾ in. in diam. and bear 1 or 2 abortive fl. Sep. and pet. linear-lanceolate acute, yellow barred with brown; upper sep. reflexed, lateral sep. hanging straight down; pet. widely spreading. Lip broadly cordate, with a short triangular acute point, and a crest of two series of tubercles in groups of 3, yellow with brown markings.

Oncidium Papilio, var. **majus**, Linden. — ? of Rchb. f. (*L.* v. 3, p. 87, pl. 138.) Merely a large flowered variety. [This is identical with var. **Eckhardti**, Linden.—*N. E. B.*]

Oncidium robustissimum, Rchb. f. (*G. C.* 1888, v. 4, p. 352; and *H. G.* 1888, p. 505.) Allied to *O. pulvinatum*, *sphegiferum*, &c., but with stout straight branches to the panicles, and larger fl. Sep. and pet. brown at base, yellow at apex. Lip yellow with brown stripes; side lobes rounded, serrate. Brazil.

Onosma pyramidalis, Hook. f. (*B. M.* t. 6987; *G. C.* 1888, v. 3, p. 305; *G. and F.* 1888, v. 1, p. 60; *H. G.* 1888, p. 230; and *R. H.* 1888, p. 480.) Boragineæ. G. or H. H. per. of ornamental character, with a large dense rosette of linear-lanceolate acute l., 10–12 in. long, and a stout, branching, leafy fl.-stem, 1½–2 ft. high. Fl. in short, dense bracteate, scorpiod, drooping racemes. Calyx lobes linear-lanceolate, very spreading. Corolla urceolate, bright scarlet. Except the corolla the whole plant is hispid. Kumaon.

Origanum hybridum, Mill. (*G. C.* 1888, v. 3, p. 232, f. 37.) Labiatæ. H. per. this is the ornamental plant known in gardens as *O. pulchellum* and *O. Tournefortii*. Levant.

Ornithochilus fuscus, Wall. (*G. C.* 1888, v. 4, p. 210) Orchideæ. A small plant with fleshy oblong l. about 4 in. long, unequally 2-lobed at the apex. Racemes axillary, pendant, with numerous, small, brownish-yellow fl. marked with purple lines. Lip 3-lobed, the middle lobe erect, horse-shoe shaped, fringed, reddish-purple, spur conical. Burma. Syn. *Æërides difforme*, Wall.

Oxybaphus californica, Benth. and Hk. f. (*Gfl.* 1888, p. 75, t. 1266, f. 2; and *H. G.* 1888, p. 175.) Nyctagineæ. H. per. 1–2 ft. high, procumbent at the base, viscid on the stem and l. L. opposite, petiolate broadly ovate, obtuse or subacute, subcordate at the base. Fl. solitary, axillary, funnel-shaped, purple, on pedicels about ½ in. long. California.

Pachystima myrsinites, Raf. (*H. G.* 1888, p. 559; and *W. G.* 1888, p. 440.) Celastrineæ. H. shr. formerly known as *Myginda myrtifolia*, Nutt.

Palicourea nicotianæfolia, *Cham. and Schl.* (*B. M.* t. 7001; *G. C.* 1888, v. 3, p. 722; and *H. G.* 1888, p. 369.) Rubiaceæ. S. shr. of ornamental character. L. opposite, petiolate, lanceolate acuminate, 5–9 in. long, bright green, the mid-rib and nerves yellowish above, purplish beneath. Panicle terminal, rather narrow, 4–7 in. long; the peduncle and branches red, pubescent; corolla tubular, 5-toothed, ½ in. long, greenish-yellow. Fruit compressed, ⅛ in. diam. violet. Brazil. Syn. *P. discolor*, of gardens.

Panax crispatum, Bull. (*Bull Cat.* 1888, p. 9; *L'Hort. Int. Cat.* 1888–9, p. 52.) Araliaceæ. S. shr. of dwarf compact habit. L. triangular, pinnate, with several pairs of overlapping leaflets, and a terminal one, all deeply incised and toothed on the margin. Brazil.

Panax lepidum, Bull. (*Ball Cat.* 1888, p. 9; *L.Hort. Int. Cat.* 1888–9, p. 52.) S. shr. of compact dense habit.

L. biternately divided, the leading division largest, pinnules of the secondary divisions obliquely obovate, with the inner sides of the two lateral ones almost covering the small central pinnule which is deflexed and sometimes almost rudimentary, the margins are deeply incised and spinosely toothed. Brazil.

Panax nitidum, Bull. (*Bull Cat.* 1888, p. 9; *L'Hort. Int. Cat.* 1888–9, p. 52.) S. shr. of dense compact habit. L. roundish-obovate, toothed and slightly spinose, the front part sometimes with two or more incisions. Brazil.

Panax ornatum, Bull. (*Bull Cat.* 1888, p. 9; *L'Hort. Int. Cat.* 1888–9, p. 52.) An ornamental S. shr. with long pinnate l., the leaflets being narrow lanceolate, and deeply and bluntly toothed on the margins. Brazil.

[**Pandanus labyrinthicus,** Kurz. Pandaneæ. This is a plant noted in *G. C.* 1888, v. 4, p. 631 under the erroneous names of *P. ceramicus,* and *P. ceramensis.* It has a stem of 1½ in. thick, bearing a crown of linear l. about 3 ft. long, by 1½ in. broad, spiny on the margins and on the apex of the keel Peduncle a ft. long, bearing a cluster of ellipsoidal cones, about 2½ in. long, by 1¾ in. thick, of a scarlet colour when ripe.—*N. E. B.*]

Papaver Pollaki, Kern. (*W. G.* 1888, p. 272.) H. per. something in the way of *P. orientale,* but with more finely cut l., and smaller dark cherry-red fl. Persia.

Paphinia cristata, var. **Modiglianiana,** Rchb. f. (*G. C.* 1888, v. 3, pp. 72 and 235; *H. G.* 1888, p. 127; *L.* v. 3, p. 45, pl. 117; and *O.* 1888, p. 200.) Orchideæ. A var. with whitish fl. Syn. *P. Modiglianii.* (*B. T. O.* 1888, p. 58.) Brazil.

Passiflora kewensis. (*Jard.* 1888, p. 201; and *G. and F.* 1888, p. 292.) Passifloraceæ. Garden hybrid.

Passiflora Miersii, Masters. (*G. C.* 1888, v. 4, p. 352, f. 46; and *H. G.* 1888, p. 505.) S. Climber. A small but pretty species, with ovate-lanceolate entire l., cordate at the base, claret-coloured beneath. Fl. about 2 in. in diam., white flushed with pink, the outer coronal threads white, barred with purple at the base, inner threads violet or deep purple. Brazil.

Pavetta natalensis, Sond. (*Bull Cat.* 1888, p. 9, and 4 with fig.; *L'Hort. Int. Cat.* 1888–9, p. 52.) Rubiaceæ. An ornamental S. shr. with lanceolate-oblong, acute, dark green, opposite l., and large hemispherical cymes of Ixora-like, white fl., with long exserted styles. Natal.

Pennisetum longistylum, var. **violaceum.** (*W. G.* 1888, p. 436.) Gramineæ. H. annual. An ornamental grass, with long metallic-violet awns to the spike.

Pentapera sicula, Klotzsch. (*B. M.* t. 7030; *G. C.* 1888, v. 4, p. 670; and *H. G.* 1888, p. 505.) Ericaceæ. G. shr. 1–2 ft. high, with linear heath-like l. ⅓–½ in. long, and terminal, 4–5-flowered umbels of nodding, urceolate, white fl., ¼ in. long, with linear, spreading, pink calyx segments. Stamens 5, included. Ovary pubescent. Sicily. Syn. *Erica sicula,* Guss.

Pentstemon Menziesii, var. **Scouleri,** A. Gray. (*H. G.* 1888, p. 560; and *W. G.* 1888, p. 560.) Scrophulariaceæ. H. per. This is *P. Scouleri* Dougl., now referred as a variety of *P. Menziesii.*

Pentstemon rotundifolius, A. Gray. (*G. C.* 1888, v. 4, p. 264–5, f. 31; *G. and F.* 1888, v. 1, p. 472, f. 73; and *H. G.* 1888, p. 503.) H. per. herb of attractive appearance, about 2 ft. high, with opposite, roundish or broadly ovate, glaucous l., those on the stem sessile; and laxly paniculate, bright brick-red, tubular fl., about 1 in. long. Mexico.

Peperomia argyreia, var. **foliis variegatis.** (*W. G.* 1888, p. 297, pl. 3.) Piperaceæ. Garden variety.

Perilla arguta, var. **atropurpurea.** (*W. G.* 1888, p. 340.) Labiatæ. A synonym of **P. nankinensis.**

Peumus fragrans, Pers. (*B. M.* t. 7024; and *G. C.* 1888, v. 4, p. 573.) Monomiaceæ. S. evergreen shr. This is the plant known as *Boldoa fragrans.*

Phaiocalanthe Sedeniana. (*G. C.* 1888, v. 3, p. 136; *H. G.* 1888, p. 176; and *O.* 1888, p. 322.) Orchideæ. A synonym of **Phaius Sedenianus,** Veitch.

[**Phaius candidissimus,** N. E. Br. Orchideæ. Much in the way of *P. Marshalliana* with a nodding infl. Bracts greenish, longer than the ovaries. Fl. entirely white. Lip trifid, the side lobes toothed in front, the front lobe crested with filiform processes; spur inflated, and 2-lobed. Syn. *Thunia candidissima,* Rchb. f. (*G. C.* 1888, v. 4, p. 34.)—*N. E. B.*]

[**Phaius Marshalliana,** var. **purpurata,** N. E. Br. A variety with a 3-lobed lip white, spotted with purple, with 5 yellow keels across the disk, and numerous yellow filiform processes; outside the front part has numerous bright purple veins. Syn. *Thunia Marshalliana*, var. *purpurata*, Rchb. f. (*G. C.* 1888, v. 4, p. 62.)—*N. E. B.*]

[**Phaius Marshalliana,** var. **triloba,** N. E. Br. A variety with a broad 3-lobed lip, having dark reddish-brown veins, and 12 darker rows of toothed crests. Syn. *Thunia Marshalliana*, var. *triloba*, Rchb. f. (*G. C.* 1888, v. 4, p. 62.)—*N. E. B.*

Phaius Sedenianus, Veitch. (*G. C.* 1888, v. 3, p. 136, under *Phaiocalanthe Sedeniana.*) Garden hybrid.

Phalænopsis Buyssoniana, Rchb. f. (*G. C.* 1888, v. 4, p. 295; *R. H.* 1888, p. 434; and *H. G.* 1888, p. 504.) Orchideæ. A handsome species very similar to *P. Regnieriana*, but brighter in colour, and differing in having the median processes on the stalk of the lip filiform-linear, instead of triangular. Sep. and pet bright purple, the side sep. bordered inside with white. Lip bright scarlet, the side lobes ochreous outside, with scarlet lines.

Phalænopsis denticulata, Rchb. f. (*G. C.* 1888, v. 3. p. 296; *L.* v. 3. p. 66; *H. G.* 1888, p. 227; and *O.* 1888, p. 164.) Allied to *P. sumatrana*, var. *Mariæ*. L. green, 6–7 in. long, 2–3 in. broad. Sep. and pet. oblong-lanceolate, acute, white with brown spots. Lip with ligulate, toothletted side lobes, having a tubercle at the base and an oblique transverse keel outside, white with yellowish tips; front lobe ligulate, acute, concave, toothletted, with a long central keel very high towards the apex, and two forked tubercles on the disk, white with 3 mauve lines on each side.

Phalænopsis gloriosa, Rchb. f. (*G. C.* 1888, v. 3, p. 554; and *H. G.* 1888, p. 308.) Seems to be a slight variety of P. amabilis with a narrow, deep, 2-toothed crest.

Phalænopsis Leda, Rolfe. (*G. C.* 1888, v. 3. p. 457; and *H. G.* 1888, p. 280.) Garden hybrid.

Phalænopsis Luddemanniano-amabilis, Rolfe. (*G. C.* 1888, v. 3, p. 331; and *H. G.* 1888, p. 228.) Garden hybrid.

Phalænopsis Stuartiana, var. **bella,** Rchb. f. (*G. C.* 1888, v. 3, p. 200; and *H. G.* 1888, p. 179.) A pretty variety, with red linear spots on the side lobes of the lip, and large purple-brown blotches on the middle lobe.

Phalænopsis sumatrana, var. **Kimballiana,** Rchb. f. (*G. C.* 1888, v. 4, p. 6; and *H. G.* 1888, p. 397.) A fine variety, with broad bright yellow sep. and pet. barred with red, and a light ochreous lip with an orange tubercle on each side lobe.

Phaseolus derasus, Schranck. (*W. G.* 1888, p. 126.) Lequminosæ. S. climber, glabrous or nearly so. L. ovate-acuminate. Fl. greenish-white in pedunculate few-flowered racemes. Seeds black, with a white hilum. Brazil.

Philadelphus Coulteri, S. Wats. (*G. and F.* 1888, v. 1, p. 232, f. 40; *R. H.* 1888, p. 385; and *W. G.* 1888, p. 440.) Saxifragaceæ. H. shr., with slender drooping branches; ovate-lanceolate, serrate l., white-pubescent beneath; and solitary white fl. about 1 in. in diam. Northern Mexico.

Philadelphus Lemoinei. (*W. G.* 1888, p. 124.) H. shr. Garden hybrid.

Philadelphus microphyllus, A. Gr. (*G. and F.* 1888, v. 1, p. 248; and *G. C.* 1887, v. 2, p. 156, f. 36.) H. A twiggy shr. with slender stems 2–3 ft. high; broadly ovate, hairy l., ½ in. long, shining green, pale beneath; and small, white, very fragrant fl. New Mexico.

Philodendron Corsinianum. (*B. T. O.* 1888, p. 211.) Araceæ. Garden hybrid.

Philopodium rigidum, of Gardens. See **Muehlenbeckia depressa.**

Phlox adsurgens, Torr. (*G. and F.* 1888, v. 1, p. 66, f. 11.) Polemoniaceæ. H. An ornamental plant with opposite, broadly ovate or ovate-lanceolate, acute l., and lax few-flowered cymes of long-tubed, rose-coloured fl. Oregon and N. W. California. [At the above place it is not stated if this plant is in cultivation.—*N. E. B.*]

Phlox Drummondii, vars. **cuspidata,** Wittm., and **fimbriata,** Wittm. (*Gfl.* 1888, p. 1–3, t. 1264.) H. annuals. In both varieties the corolla lobes are 3-toothed, but in var. **cuspidata** the middle tooth is 4–5 times as long as the side teeth, whilst in var. **fimbriata** it is only about twice as long. Syn. *Drummondi*, vars. *stellata*, and *laciniata*, Grilli. (*B. T. O.* 1888, p. 119, f. 18–19, and p. 243.)

Phlox nana, Nutt. (*G. and F.* 1888, v. 1, p. 413, f. 66.) H. ? per. of dwarf habit, 6–9 in. high. A very pretty species, with spreading, linear-attenuate l. 2–3 in. long, and lax corymbs of red, white, or yellow fl., an inch in diam., with elliptic, entire corolla lobes. Texas.

Phormium Hookeri, Gunn. (*B. M.* t. 6973; *H. G.* 1888, p. 124; *G. and F.* 1888, v. 1, p. 48; *R. H.* 1888, p. 479.)

Liliaceæ. H. per. resembling *P. Colensoi*, with flaccid ensiform l., fissured at the apex, of a pale green without a coloured margin; and a tall panicle of slightly curved fl., with the outer segments yellow, and the inner greenish; filaments red. New Zealand.

Phillyrea decora, Boiss. and Bal. (*G. C.* 1888, v. 4, p. 672, f. 96.) Oleaceæ. H. shr. The above is the earliest name for *P. Vilmoriniana*, Boiss.

Phytolacca decandra albo-variegata. (*Jard.* 1888, p. 59, with fig.) Phytolaccaceæ. Garden var.

Picea pungens, var. **argentea,** Engelm. (*H. G.* 1888, p. 70.) Coniferæ. H. This is the corrected name for the tree known in gardens as *P. Parryana* var. *glauca*.

Pilocereus Bruennowii, Haage. (*H. G.* 1888, p. 85, with fig.) Cactaceæ. G. or S. succulent with columnar, 9–12 angled stems; something in the way of *P. fossulatus*, but with stronger and longer spines, and stouter and longer hairs. Bolivia.

Pilocereus Hoppenstedti, Roezl. (*H. G.* 1888, p. 8, with fig.) G. or S. succulent, with columnar, 18–20 angled stems, the angles rounded, with deep acute grooves between them. Pulvini close set, white tomentose, outer spines about 20, unequal in length, the lower ones longest, grayish white, central spines 6–8, brownish, stout at the base, the lower ones as much as 2½ in. long. Mexico.

Pinanga lepida, Bull. (*Bull Cat.* 1888, p. 9; *L'Hort. Int. Cat.* 1888–9, p. 52.) Palmæ. S. An elegant palm with short rufescent petioles, and the blade pinnately divided into unequal segments. Young leaves brownish-red, changing to deep green, faintly mottled with darker. East Indies.

Pinus ponderosa, var. **scopulorum,** Engelm. (*H. G.* 1888, p. 559.) Coniferæ. H. tree. A variety with shorter l. and smaller cones. Rocky Mountains.

Piper rubrovenosum, Rodigas. (*Ill. H.* 1887, p. 91, pl. 33; and *H. G.* 1888, p. 124.) Piperaceæ. S. An ornamental climber, with cordate-acuminate, bright green l., mottled above, with rosy along the course of the veins, green beneath. [This seems scarcely to differ from the plant I described as **Piper Ornatum.**—*N. E. B.*]

Pirus. See **Pyrus.**

Pitcairnia Darblayana, Sallier. (*Jard.* 1888, p. 201; and *W. G.* 1888, p. 383.) Bromeliaceæ. Garden hybrid.

Pitcairnia jaliscana, S. Wats. (*G. and F.* 1888, v. 1, p. 195.) An attractive species with a bulb-like base, composed of very short, broadly sheathing l., armed with reflexed spines on the margins. L. linear, erect, unarmed, scurfy beneath. Fl.-stem glabrous, bracteate. Fl. numerous, pedicellate; bracts and calyx, deep rose-coloured; corolla nearly 2 in. long, scarlet. Mexico. Perhaps not in cultivation.

Pitcairnia Palmeri, S. Wats. (*G. and F.* 1888, v. 1, p. 209, and 211 f. 38.) A small species, with a bulbous base formed of broad leaf-sheaths, and a few filiform or linear l., those on the barren shoots sparsely hairy, those on the flowering shoot, barbed. Fl. stem with slender subulate entire l. Fl. in a lax raceme, bracts narrow, half as long as the recurved pedicels. Corolla 1¼ in. long, light red. Mexico.

Pithecoctenium buccinatorium, DC. (*B. T. O.* 1888, p. 272, t. 11.) Bignoniaceæ. This is the handsome S. climber, figured by Lindley in the Botanical Register, t. 1301 as *Bignonia cherere*, but is distinct from *B. cherere*, Aubl.

Pittosporum phillyrœoides, DC. (*B. T. O.* 1888, p. 328, t. 13.) Pittosporeæ. A graceful G. shr. with slender drooping branches, linear l., 2–3 in. long, and axillary yellow fl. about ⅕ of an in. in diam. Australia.

Pleurothallis platystachys, Regel. (*Gfl.* 1888, p. 459.) Orchideæ. Tufted. L. leathery, lanceolate, 2-toothed at apex. Scape as long as the l., with about 4 keeled, imbricated, dull green bracts; and a compressed spike of small green fl., dotted with purple. Brazil.

Pleurothallis punctulata, Rolfe. (*G. C.* 1888, v. 4, p. 756.) Rather a pretty species. L. 3¼ in. long, 1 in. broad, lanceolate oblong, subacute, fleshy, glaucous below, on stems about 2 in. high. Peduncle 2½ in long. Fl. an in. long, light yellow, spotted with purple-brown. Upper sep. lanceolate-oblong, acute; side sep. united into a concave oblong body, bifid at apex. New Grenada.

Pleurothallis Roezli, Rchb. f. (*O.* 1888, p. 80, with pl.) An attractive species, with large purple-brown fl. L. 3–5 in. long, 1–1¼ in. broad, oblong-lanceolate, 2-toothed at the apex. Peduncle rather longer than the l., the flower-bearing part drooping. Fl. 5–6 in a one-sided raceme, about 1 in. long, the upper sep. nearly parallel with the lower sep., which are united to their apex, so that the fl. is open but a little way. Columbia.

Platycarya strobilacea, Sieb. and Zucc. (*R. H.* 1888, p. 88, f. 18–19.) Juglandeæ. This is an older name for ***Fortunœa chinensis,*** Lindl., a very curious H. H. shr.

Polygonum baldschuanicum, Regel. (*Gfl.* 1888, p. 409, t. 1278; and *H. G.* 1888, p. 461.) Polygonaceæ. H. per. of climbing habit, very free-flowering and ornamental. L. 1–1½ in. long, cordate-ovate, acute, petiolate. Fl. in large terminal panicles, bright pink. Eastern Buchara.

Polypodium californicum, Kaulf. (*G. and F.* 1888, v. 1, p. 341.) Filices. H. H. or H. Fern about 9 in. high. Fronds pinnate, lanceolate or ovate-lanceolate, the segments narrow, oblong, acute, serrate, placed rather close together. California.

Polystachya leonensis, Rchb. f. (*G. C.* 1888, v. 3, p. 648.) Orchideæ. An unattractive species, with thick velvetty roots, depressed-globose bulbs, ½ in. in diam., arranged on the rhizome so as to touch one another, velvetty scape and pedicels, and racemose light green fl. with a white lip, covered with a white meal on the central keel and basal part. Sierra Leone.

Populus Steiniana, Bornm. (*Gfl.* 1888, p. 173, f. 37–38, and p. 396; and *G. and F.* 1888, v. 1, p. 139.) Salicaceæ. Garden hybrid.

Portenschlagia ramosissima, Vis. (*W. G.* 1888, p. 339.) Umbelliferæ. H. per. with ternately decompound l., cut into linear ultimate segments, ½–1 in. long. Stem verticillately branched; umbels compound, dense; fl. yellowish-white; fr. shortly hairy. Dalmatia.

Prasophyllum Laufferianum, Maury. (*Journal de Botanique,* 1888, p. 302–3, with fig.) Orchideæ. G. terrestrial Orchid, with one slender terete l. channelled down one side, and a spike of several fl. about an in. in expanse. Sep. linear-lanceolate, dusky green. Lip. ovate-oblong, acute, recurved, with wavy edges, and two wavy folds running parallel with the margin and meeting near the apex. Australia.

Primula geraniifolia, Hook. f. (*B. M. t.* 6984; *G. C.* 1888, v. 3, p. 305; *H. G.* 1888, p. 230; and *R. H.* 1888, p. 480.) Primulaceæ. H. per. A pretty Primrose, with roundish-cordate, obtuse, bluntly lobed, hairy l., on distinct hairy petioles; and a several flowered umbel of bright purple fl. ¼ in. in diam., on long hairy scapes. Eastern Himalayas.

Primula suffrutescens, Gray. (*G. C.* 1888, v. 4, p. 38.) H. alpine primrose, with creeping stems and rosettes of evergreen, thick, leathery, spathulate l., coarsely toothed at the apex. Scapes 3–4 in. high, bearing 3-7 deep maroon-purple fl., with a yellow eye, about an inch in diam. Sierra Nevada.

Prunus Capuli, Cav. (*R. H.* 1888, p. 137, f. 30.) Rosaceæ. H. shr. or small tree, with deciduous oblong or elliptic-oblong, acute, finely-toothed l., glaucous green beneath; and terminal racemes of white fl. similar to those of *P. padus.* Fr. red, pulpy, resembling a small cherry. The Capollin or Capulinos of Mexico.

Prunus Jacquemontii, Hk. f. (*B. M. t.* 6976; *G. and F.* 1888, v. 1, pp. 48, 200; *H. G.* 1888, p. 124, and *R. H.* 1888, p. 479.) H. shr. with slender glabrous branches; ovate, ovate-lanceolate, or elliptic, acute, serrate l., and clusters of 2–3 pink fl., about ⅓ in. in diam., appearing with the l. Calyx tubular, ⅙–¼ in. long, glabrous. N. W. Himalaya.

Prunus Maureri, Zabel. (*Gfl.* 1888, p. 124.) Garden hybrid.

Prunus Miqueliana, Maxim? (*G. and F.* 1888, p. 196 and 199, f. 37.) H. tree. This is said to be confounded in gardens with *P. pendula* Maxim., but the bark is darker, the fl. are corymbose on short leafy shoots, the pedicels bracteate at the base, and as well as the shorter and paler calyx sparsely hairy, the pet. are more narrowly obovate, and of a paler pink or nearly white, the l. are broader, thinner, and more deeply and irregularly cut, pubescent beneath, as are the petioles and young shoots, and have 2 orange glands at their base.

Ptarmica grandiflora, var. **flore pleno,** Carriere. (*R H.* 1888, p. 573.) Compositæ. H. per. A double flowered form of **Achillea grandiflora,** Marsch.

Puya lanuginosa, R. and P. (*G. C.* 1888, v. 4, p. 411.) Bromeliaceæ. S. A rather smaller species than *P. chinensis,* with recurved, toothed l., silvery beneath, and a fl.-stem 3–4 ft. high. Fl. densely packed; calyx clothed with brown woolly hairs; corolla 2 in. long, pale sea-green. Peru.

Pyrus Halliana, and **P. Parkmanni,** of gardens. (*G. and F.* 1888, v. 1, p. 152; and *W. G.* 1888, p. 123.) Rosaceæ. These names represent a semidouble form of **P. floribunda.**

Pyrus heterophylla, Regel and Schmalh not of Steud. (*H. G.* 1888, p. 560.) L. entire on laciniate, or intermediate. Central Asia.

Quercus Daimio, var. **pinnatifida.** (*W. G.* 1888, p. 287.) Cupuliferæ. H. tree. A form with very large pinnatisect l., attaining a ft. or more in length. [This is probably a laciniate form of **Q. dentata.**—*N. E. B.*]

Quercus georgiana, M. A. Curtis. (*G. and F.* 1888, v. 1, p. 465.) H. An ornamental and very rare shr., the foliage turning scarlet in autumn. It forms a low spreading bush, and has long-stalked, somewhat obovate l., cuneate at the base, with 3–5 entire, acute or obtuse lobes, with deep or shallow sinuses, very smooth; and with smooth, shining, saucer-shaped cups, and ellipsoid acorns. Georgia.

Quesnelia Enderi, Gravis and Wittm. (*Gfl.* 1888, p. 195, f. 41–43.) Bromeliaceæ. This is a synonym of **Q. lateralis,** Wawra, and is the same as *Billbergia Enderi*, Regel.

Quesnelia Wittmackiana, Regel. (*Gfl.* 1888, p. 497, t. 1281, f. 2.) A distinct looking plant, with stiff, erect, channelled l., 3–4½ ft. long, with small spines on the edges, light green, transversely banded with whitish on the back. Fl. stem shorter than the l., slender, reddish, bracteate. Spike short, composed of about 4 clusters of 2–3 fl., with red calyces and dark blue pet. South Brazil. ?

Rhododendron balsaminæflorum, var. **carneum,** Veitch. (*Veitch Cat.* 1888, p. 12, and p. 7 with fig.) Ericaceæ. Garden hybrid

Rhododendron brachycarpum, G. Don. (*G. and F.* 1888, v. 1, p. 292, f. 46.) H. shr. A handsome, tall growing, wide branching species, resembling *R. catawbiense* in general appearance. L. oblong obtuse, shortly mucronate, with a rusty, silky pubescence beneath. Fl. numerous, 1½–1¾ in. in diam., in large terminal clusters, pale yellow, or cream colour dotted with green at the base of the upper lobes of the corolla. Japan.

Rhododendron Championi, Hook. (*G. C.* 1888, v. 3, p. 620.) G. Shr. with leathery l., about 5 in. long, by 2 in. broad, covered on both sides with glandular hairs; and handsome white fl. spotted with yellow in the upper part, about 4 in. in diam., with spreading segments. China.

Rhododendron Colletianum, Ait. and Hemsl. (*B. M.*, t. 7017; *G. C.* 1888, v. 3, p. 620, and v. 4, p. 297, f. 38, and p. 416; and *H. G.* 1888, pp. 504, 553.) H. shr. L. oblong-lanceolate, acute at both ends, coriaceous, opaque green above, pale brownish-lepidote beneath, 1½-3 in. long. Fl. nearly an in. long, funnel-shaped, with broadly oblong lobes, pure white, arranged in dense terminal umbels. Afghanistan.

Rhododendron jasminiflorum, var. **carminatum,** Veitch. (*Veitch Cat.* 1888, p. 13, and p. 8, with fig.) Garden hybrid.

Rhododendron kewensis, W. Watson. (*G. C.* 1888, v. 3, p. 620.) Garden hybrid.

Rhododendron Vaseyi, A. Gray. (*G. and F.* 1888, v. 1, p. 376, f. 60, and p. 440; and *G. C.* 1888, v. 4, p. 569.) H. A beautiful shr., growing 15–18 ft. in height, but flowering freely when only a ft. high. L. oblanceolate, acute, cuneate at the base, 2½–3 in. long, not expanded when flowering. Fl. in lax umbels, bright clear pink, dotted with darker at the base of the upper lobes of the corolla, which is about 1½ in. in expanse. Carolina.

Rodriguezia Bungerothi, Rchb. f. (*L.*, v. 3, p. 65, pl. 127; *G. C.* 1888, v. 3, pp. 264, 561; *H. G.* 1888, p. 226; *L'Hort. Int. Cat.* 1888–9, p. 45; and *O.* 1888, p. 163.) Orchideæ. Much in the way of *R. secunda.* Bulbs 1½ in. long, compressed, oblong. L. 2–3, strap-shaped, acute, 5–6 in. long by 1 in. broad. Fl. in a dense raceme, bright carmine-rose according to the plate, purplish according to description. Sep. and pet. elliptic-ovate. Lip cuneate-obovate, emarginate. Spur rather stout, solid at the base. Venezuela.

Rosa alba, var. **suaveolens,** Dieck. (*W. G.* 1888, p. 561.) Rosaceæ. No description. One of the kinds yielding Attar of Roses. Kazanlick.

Rosa Beggeriana, Schrenk. (*G. and F.* 1888, v. 1, p. 333.) H. shr., 4–6 ft. high, flowering all the summer. Branches slender, with a few recurved spines and no prickles. L. with 3–4 pairs of small, elliptic, serrate leaflets. Fl. small, white, in several-flowered corymbs. Fruit not much larger than a pea, at first orange-red, deep purple-black when ripe. Afghanistan.

Rosa byzantina, Dieck. (*H. G.* 1888, p. 561.) No description. Yields Attar of Roses. Constantinople.

Rosa Fendleri, Crép. (*H. G.* 1888, p. 560.) G. Rose, resembling *R. blanda*, and probably only a slight form of that species. Mexico.

Rosa gallica, var. **trigintipetala,** Dieck. (*W. G.* 1888, p. 561.) No description. Yields Attar of Roses. Kazanlick.

Rosa gigantea, Crépin. (*G. C.* 1888, v. 4, p. 122; *G. and F.* 1888, v. 1, p. 321; *Gfl.* 1888, p. 516; and *H. G.* 1888, p. 456.) G. or S. A very fine Rose, something in the way of *R. chinensis*, Jacq., but larger, and differing in having solitary white fl. 5 in. in diam., with entire outer sep. and unarmed floral branches. Burmah, Siam.

Rosa minutifolia, Engelm. (*G. and F.* 1888, v. 1, p. 102, f. 22.) H.? or H. H. Rose, of compact much branched habit, armed with numerous straight spines, with very small l., of 5–7 deeply-toothed leaflets, and small solitary pink or white fl. on short spurs along the branches. California.

Rosa Niphetos, var. **striata.** (*B. T. O.* 1888, p. 157.) Garden variety.

Rosa nutkana, Presl. (*G. and F.* 1888, v. 1, p. 449, f. 70, and *H. G.* 1888, p. 560.) H. A showy Rose of stout habit, with rather broad foliage; usually armed at the base of the l. with broad flat spines, and occasionally with scattered prickles. L. glabrous or pubescent. Fl. large in lax corymbs, peduncles and ovaries smooth, unarmed. Fr. globose, ½ in. diam., bright scarlet. N.W. America.

Rosa omissa, Desegl. (*H. G.* 1888, p. 560.) H. Allied to *R. mollis*, with moderate-sized leaflets, glandular beneath. The fl. are rose-coloured, and the fr. obovoid or pear-shaped, glabrous. France.

Rosa phœnicea, Boiss. (*H. G.* 1888, p. 560.) H. An ornamental Rose with climbing stems, armed with scattered hooked prickles, pinnate l. with 3–5 elliptic, obtuse, coarsely-toothed leaflets, and corymbose panicles of white fl. Syria.

Rubus trifidus, Thunb. (*G. and F.* 1888, p. 273.) Rosaceæ. H. shr. of robust habit, with semi-erect stems, large deeply-divided l., and clusters of showy rose-coloured fl. Japan.

Rubus ursinus, Ch. and Sch. (*H. G.* 1888, p. 561.) H. Stems rather weak and trailing, armed with rather slender prickles. L. with 3 or rarely 5 ovate or elliptic, variously toothed, more or less tomentose leaflets. Fl. white in small corymbs. Fr. black. California.

Ruellia Devosiana, var. **Grilliana,** Piergr. (*B. T. O.* 1888, p. 332.) Acanthaceæ. Garden variety.

Sabal Blackburniana, var. **nobilis,** Lodd. Glaz. (*W. G.* 1888, p. 240.) Palmæ. The above is mentioned at the place quoted, without description.

Saccolabium cerinum, Rchb. f. (*G. C.* 1888, v. 4, p. 206, and *H. G.* 1888, p. 458.) Orchideæ. A rather curious species, with dark, oblong, bilobed l., and racemes of numerous, ascending, waxy, orange fl., with an apricot-coloured spur. Sunda isles.

Salix balsamifera, Barratt. (*G. and F.* 1888, p. 246.) Salicineæ. H. shr. 4–10 ft. high, said to be a very handsome Willow. L. 2–3 in. long, 1–1½ in. broad, acute or acuminate, broadly rounded or subcordate at base, of a rich reddish colour when young, becoming dark green above, paler or glaucous beneath, glabrous. Catkins dense, 1–1½ in. long; males very silky, with rosy scales; females less silky, becoming very lax in fruit, 2 in. or more long, fruit beaked, on long pedicels. Eastern N. America.

Salix chlorophylla, Anders. (*G. and F.* 1888, v. 1, p. 154.) H. Alpine Willow, forming a low spreading bush a few inches high. L. oblong-lanceolate, or obovate-oblong, entire, bright green, silky beneath. Catkins dense. Fr. tomentose. N. America.

Salvia scapiformis, Hance. (*B. M.*, t. 6980; *G. C.* 1888, v. 3, p. 242; *H. G.* 1888, p. 80; and *R. H.* 1888, p. 479.) Labiateæ. H. H. or G. per. herb, with petiolate, broadly ovate, or cordate-oblong, bluntly-toothed, glabrous radical l., and long slender leafless racemes of pale blue fl. in whorls, arising from the rootstock. Formosa.

Sambucus racemosus, var. **arborescens.** (*H. G.* 1888, p. 561.) Caprifoliaceæ. H. A variety with larger l., composed of 7–9 oblong leaflets. Rocky Mountains.

Sarcochilus Hartmanni, Muell. (*B. M.*, t. 7010, and *G. C.* 1888, v. 4, p. 186.) Orchideæ. This is the plant known also as *Thrixspermum Hartmanni*. Queensland.

Saxifraga luteo-purpurea, Lab. (*G. C.* 1888, v. 3, p. 365.) Saxifragaceæ. This is the corrected name of the plant recorded in last year's list, p. 119, as *S. media*, var. *Frederici-Augusti*.

Saxifraga macropetala Kerner. (*G. C.* 1888, v. 3, p. 556.) H. Alpine, like *S. oppositifolia*, with crowded, roundish, or cuneate, obtuse, ciliate, pitted l., and deep lilac fl., resembling those of *S. oppositifolia*. The ovary has a ring-like disk around its base. Tyrol.

Saxifraga oppositifolia, var. **pallida,** For a notice of this form see *G. C.* 1888, v. 3, p. 714.

Saxifraga tombeanensis, Boiss. (*Jard.* 1888, p. 179.) H. Alpine per., something in the way of *S. Burseriana*, with rosettes of small, erect, ovate-lanceolate, or subulate l., and similar l. on the stems, but glandular-hairy, and bright red glandular-hairy stems, bearing 3–4 white fl. Tyrol.

Scabiosa Victoriæ, Dam. (*W. G.* 1888, p. 437.) Dipsaceæ. Garden hybrid.

Schomburgkia rhionodora, var. **Kimballiana,** Rchb. f. (*G. C.* 1888, v. 3, p. 136; *H. G.* 1888, p. 176; and *O.* 1888, p. 197.) Orchideæ. A variety with the branches and fl. light purple.

Scorodosma fœtidum, Bunge. (*W. G.* 1888, p. 74, f. 13.) Umbelliferæ. This is the same as **Narthex asafœtida,** Falc.

Scuticaria Hadweni, Bth. and Hk. (*O.* 1888, p. 164.) Orchideæ. This is the old *Bifrenaria Hadweni,* Ldl. referred by the authors of the Genera Plantarum to **Scuticaria.**

Selenipedium chlorops, Rchb. f. (*G. C.* 1888, v. 3, p. 584; and *H. G.* 1888, p. 308.) Syn. *Cypripedium chlorops,* Rchb. f. Garden hybrid.

Selenipedium nitidissimum, Rchb. f. (*G. C.* 1888, v. 4, p. 6.) Syn. *Cypripedium nitidissimum.* Garden hybrid.

Senecio elegans pomponicus cupreus. (*W. G.* 1888, p. 437.) Compositæ. Garden variety.

Shortia galacifolia, A. Gray. (*G. and F.* 1888, v. 1, p. 506, and p. 509, f. 80.) Diapensiaceæ. H. per. A pretty and very interesting little plant, with the habit of a Pyrola. L. all radical, broadly elliptic, or roundish, obtuse, crenate, on long stalks. Scapes slender, 3–4 in. long, 1-flowered. Fl. an in. in diam., 5-lobed, with a short funnel-shaped tube. Carolina.

Skimmia Foremanni, Foremann. (*G. C.* 1888, v. 4, pp. 709, 735.) Rutaceæ. Garden hybrid.

Smilax glycophylla, Sm. (*Gfl.* 1888, p. 343–4, f. 74.) Liliaceæ. G. climber, with smooth stems, lanceolate, acuminate 3-nerved l., shining green above, greyish-green beneath, and clusters of globose black berries. Australia.

Smilax pseudochina, L. (*G. and F.* 1888, v. 1, p. 249.) H. Climber with unarmed stems; large ovate, acute l., subcordate, and then shortly cuneate at the attachment of the petiole; and long-stalked umbels of greenish fl., succeeded by black berries. N. America.

Smilax rotundifolia, Linn. (*G. and F.* 1888, v. 1, p. 249.) H. Shr. with tough, climbing, spiny, or unarmed stems, broadly ovate or roundish l., and axillary umbels of small fl. N. America.

Sobralia macrantha, var. **Kienastiana,** Rchb. f. (*G. C.* 1888, v. 4, p. 296; and *H. G.* 1888, p. 504.) Orchideæ. A white flowered variety, with a small yellow mark on the lip.

Solanum ciliatum, var. **macrocarpum,** Carr. (*R. H.* 1888, p. 78, f. 16; *B. T. O.* 1888, p. 117; and *W. G.* 1888, p. 117.) Solanaceæ. S. per. A variety with fr. 1½ in. in diam.

Sphæralcea Emoryi, Torr. (*Gfl.* 1888, p. 73, t. 1266, f. 1; and *H. G.* 1888, p. 175.) Malvaceæ. H. per. 1–2 ft. high. L. petiolate, broadly ovate, pinnatifidly lobed and toothed. Fl. several together from the axils of the l., small, orange-red, on slender pedicels. California

Spathoglottis Kimballiana. (*G. C.* 1888, v. 4, p. 92 and 93, f. 9; and *G. and F.* 1888, v. 1, pp. 124, 224.) Orchideæ. A garden name for **S. aurea.**

Spathoglottis Viellardi, Rchb. f. (*B. M.* t. 7013; *G. C.* 1888, v. 4, p. 300; and *H. G.* 1888, p. 506.) This is an older name for *S. Augustorum,* Rchb. f.

Spiræa pubescens, Turcz. (*G. and F.* 1888, v. 1, p. 330, f. 52.) Rosaceæ. H. A pretty, free-flowering, dwarf shr., with rather small ovate-oblong, obtuse l., toothed above the middle, puberulous above, densely villous-pubescent beneath; and numerous umbels of white fl., placed in close array on very short lateral shoots, along the slender zigzag branches. North China. N.B.—This should not be confused with *S. pubescens,* Lindl, which is now considered to be the same as **S. dasyantha,** Bunge.

Stachys tuberifera, Naud. (*G. C.* 1887, v.   p.   ; 1888, v. 3, p. 16, p. 13, f. 1, and p. 211; *R. H.* 1887, p. 290; *G. and F.* 1888, v. 1, p. 4; *Gfl.* 1888, p. 99, and *H. G.* 1888, p. 99.) Labiatæ. H. per. something in the way of *S. arvensis,* producing numerous tubers, used as a vegetable. When first introduced it was thought to be *S. affinis,* Fresen (see Ill. H. 1886, p. 136; and R. H. 1887, p. 266), but was subsequently considered to be distinct by Mr. Naudin. North China, Japan.

Statice eximia, var. **turkestanica,** Regel. (*Gfl.* 1888, p. 194, t. 1270, f. d.–m., and p. 266; *G. C.* 1888, v. 3, p. 564; and *H. G.* 1888, p. 279.) Plumbagineæ. H. per. An ornamental species, with a rosette of lanceolate acute l., 6–8 in. long, by 1½–2 in. broad; and several branching fl.-stems 2–2⅓ ft. high, with short dense spikes of lilac fl. ending the branches. Turkestan.

Stephanandra incisa, Zabel. (*Gfl.* 1888, p. 537.) Rosaceæ. A synonym for **S. flexuosa.**

Strelitzia Nivenii. (*R. H.* 1888, p. 117.) Scitamineæ. Garden hybrid.

Streptocarpus parviflora, E. Mey. (*G. C.* 1888, v. 3, p. 800.) Gesneraceæ. G. herbaceous per., with a rosette of elongate-oblong, or lanceolate-oblong, obtuse, softly hairy l., and pedunculate few-flowered cymes of tubular fl., about ¾ in. long, and about the same in diam. across the spreading limb of the corolla, which is white with a little yellow on the lower side of the throat, tube pale violet inside and out. S. Africa. N.B.—The plant figured in the Botanical Magazine, t. 6636, as *S. parviflora,* is **S. lutea,** Clarke.

Stropholirion californicum, Torr. (*G. and F.* 1888, v. 1, p. 291.) Liliaceæ. Another name for **Brodiæa volubilis,** Baker.

Stuartia pseudo-cæmellia, Maxim. (*G. C.* 1888, v. 4, p. 188 and 187, f. 22; *G. and F.* 1888, p. 315; *H. G.* 1888, p. 458; and *W. G.* 1888, p. 391.) The corrected name for *S. grandiflora,* Briot.

Styrax obassia, Sieb. and Zucc. (*G. C.* 1888, v. 4, p. 133 and 131, f. 14; *B. T. O.* 1888, p. 347; *H. G.* 1888, p. 457; *R. H.* 1888, p. 410; and *W. G.* 1888, p. 439.) H. shr. of ornamented character. L. elliptic or roundish cuspidate, 3–8 in. long, and as much broad, petiolate, denticulate. Racemes 6–8 in. long, bearing numerous fragrant white fl., 1–1¼ in. in diam. Japan.

Symphoricarpus acutus. (*H. G.* 1888, p. 562.) Caprifoliaceæ. H. shr. with oblong-lanceolate, acute or acuminate, softly tomentulose l., which are acute at the base, and sometimes toothed. This is the **S. nollis** var. **acutus,** A. Gray. N. W. America.

Symphoricarpus occidentalis, var. **Heyeri,** Dieck. (*H. G.* 1888, p. 562.) H. shr. A form with rhomboid l. of firm texture, with prominent veins, and pretty, rosy fl. Colorado.

Symphyandra Hoffmanni, Pantozsek. (*W. G.* 1884, p. 352, f. 53; *G. C.* 1888, p. 760, f. 107.) Campanulaceæ. H. per allied to *S. pendula,* but more robust and more floriferous, 1–2 ft. high, softly hairy. L. lanceolate acute, serrate. Fl. white, drooping, 1–1½ in. long; the calyx-lobes ovate-lanceolate, acute, entire. Bosnia.

Syringa amurensis, Rupr. (*G. and F.* 1888, v. 1, pp. 222, 453; and *W. G.* 1888, p. 274.) Oleaceæ. H. shr. 6–8 ft. high. L. ovate or oblong, obtuse, or acuminate, contracted into a long channelled petiole. Fl. white, in a dense panicle, corolla tube included in the short calyx. Mandchuria.

Syringa emodi, var. **rosea,** Cornu. (*R. H.* 1888, p. 492, with pl.) Oleaceæ. A variety with rosy-lilac fl. China. See **S. villosa.**

Syringa japonica, Maxim. (*G. and F.* 1888, v. 1, p. 222.) H. tree. L. broadly ovate acuminate, villous-pubescent beneath. Panicle many flowered. Calyx denticulate, pubescent, as long as the corolla-tube.

Syringa pekinensis, Rupr. (*G. and F.* 1888, v. 1, pp. 222, 453.) H. A small tree with long, graceful, flexuous branches. L. ovate, on deltoid, obtuse or acuminate, on long slender petioles, dark green, paler beneath. Panicle dense. Fl. white, with the corolla-tube scarcely longer than the obscurely denticulate calyx. China.

Syringa pubescens, Turcz. (*G. and F.* 1888, v. 1, p. 414, f. 67.) H. A beautiful free-flowering shr. of compact habit, 3–5 ft. high, with ascending slender branches; rather small elliptic-ovate acute l., 1½–2 in. long, pale beneath, with a pubescent midrib, and panicles of long-tubed, pale rose coloured fl., that are very fragrant. North China.

Syringa villosa, Vahl. (*G. and F.* 1888, v. 1, p. 222, and p. 520, f. 83.) H. shr., very similar to *S. emodi,* and *S. Josikæa,* but differing in having the underside of the l. clothed with long white hairs. At the last quoted page it states that this appears to be the same as *S. emodi* var. *rosea* of the R. H. China.

Talisia princeps, Oliver. (*G. C.* 1888, v. 3, p. 806.) Sapindaceæ. S. tree. This is the ornamental tree known in gardens as *Theophrasta pinnata, Brownea princeps,* and *B. erecta.* It has an unbranched stem, with a crown of spreading pinnate l. about 6 ft. long, and large branching panicles of small whitish fl. Venezuela.

Thunia candidissima, Rchb. f. (*G. C.* 1888, v. 4, p. 34; and *H. G.* 1888, p. 397.) Orchideæ. See **Phaius candidissimus.**

Thunia Marshalliana, vars. **triloba** and **purpurata,** Rchb. f. (*G. C.* 1888, v. 4, p. 62; and *H. G.* 1888, p. 397.) See **Phaius Marshalliana.**

Thunia nivalis. [Prof. Reichenbach mentions this species under *T. Marshalliana* var. *triloba,* in *G. C.* 1888, v. 4, p. 62. But I have been unable to find where it is described.—*N. E. Br.*]

Thymus serpyllum, var. **atropurpureus,** Backhouse. (*G. C.* 1888, v. 3, p. 650; and *W. G.* 1888, p. 275.) Labiatæ. H. alpine variety, of a dark purple colour. North of England. See also p. 714 of the same work, where a var. **coccineus,** Backh., is mentioned.

Thyrsacanthus coccineus, Regel. (*Gfl.* 1888, p. 128.) Acanthaceæ. A synonym of **T. Lemairianus,** Nees.

Thyrsacanthus Lemairianus, Nees. (*Gfl.* 1888, p. 128.) A shr. This is the corrected name for the plant known in gardens as *Eranthemum coccinea,* Syn. *Thyrsacanthus coccineus,* Regel.

Tigridia Pringlei, S. Wats. (*G. and F.* 1888, p. 388, f. 61.) Iridaceæ. H. H. bulb. Much like the familiar *T. pavonia,* and quite as showy, chiefly differing in the pet. being broadly cordate or reniform at the base, with a narrower, small, triangular-ovate, acute blade. Sep. bright scarlet-red, the base blotched with crimson, with a border of orange. Pet. with the base blotched with crimson, having a well defined brownish margin, the blade orange, tinged with scarlet, not spotted. Chihuahua.

Tilia europæa, var. **pyramidalis aurea.** (*W. G.* 1888, p. 164.) Tiliaceæ. Garden variety.

Tillandsia Alberti, André. (*R. H.* 1888, p. 577.) Bromeliaceæ. Garden hybrid.

Trias picta, Rolfe. (*G. C.* 1888, v. 3, p. 488.) Orchideæ. A small orchid with 4-angled bulbs, narrow ovate acuminate fleshy l., and fleshy fl., ¾ in. in diam, honey-coloured, densely spotted with reddish-purple. Burmah.

Trichopilia Lehmanni, Regel. (*Gfl.* 1888, p. 355, t. 1276, f. 2; and *H. G.* 1888, p. 401.) Orchideæ. Something in the way of *T. fragrans,* but with a 1-flowered peduncle. Bulb ovate, compressed. L. solitary oblong-lanceolate obtuse. Scape 2–3 in long, bracteate. Ovary white. Sep. and pet. linear-lanceolate acute, 1½ in. long. Lip with a large oblong front lobe. Fl. white, with a yellow spot in the throat of the lip.

Tritoma Canari, Carr. (*R. H.* 1888, p. 295.) Liliaceæ, H. per. A yellow-flowered form of **Kniphofia aloides.**

Tulipa Greigi, var. **æstuans, aurea, aurea opidabilis,** (? an error for **spectabilis**), **aurea superba, aurea zonata, carminea, compta, imperialis, parviflora, parviflora amœna, parviflora aurea, parviflora chrysantha, parviflora sulphurea, picta, Victoriæ,** Damman. (*W. G.* 1888, pp. 333–334.) Liliaceæ. Garden varieties.

Tulipa libanotica, Regel. (*Gfl.* 1888, p. 126.) H. Tulip allied to *T. Boissieri* and *T. linifolia,* with flaccid linear l. wavy and ciliate on the margins. Scape glabrous. Fl. purple with an elongate blackish spot at the base of the oblanceolate segments. Anthers shorter than the filaments.

Vanda lamellata, var. **Boxallii superba.** (*L.* v. 3, p. 83, pl. 136.) A fine variety, with the upper sep. and pet. white, spotted at the apex with claret colour; the later sep. and lip. for the greater part claret-coloured edged and flaked with white. Syn. *V. Superba,* Linden.

Vanda superba, Linden. (*L.* v. 3, p. 83, pl. 136; and *G. C.* 1888, v. 3, p. 806.) See **V. lamellata** var. **Boxallii superba.**

Verminiaria denudata. (*W. G.* 1888, p. 272.) Lequminosæ. A misprint for **Viminaria denudata,** Sm.

Veronica cupressoides, Hook f. var. **variabilis** N. E. Br. (*G. C.* 1888, v. 3, p. 20, f. 5 and 7.) Scrophulariaceæ. The corrected name for the plant cultivated as *V. salicornioides.* New Zealand.

Veronica Godefroyana, Carr. (*R. H.* 1888, p. 455; *Jard.* 1888, p. 249; and *W. G.* 1888, p. 470. H. evergreen shrub, forming a spherical bush 1½-3 ft. high. L. ½ in. long, ¼ broad, oblong obtuse, narrowed at the base, thick in texture, concave, glaucous green. Fl. in axillary compact racemes, small, very numerous, white. New Zealand. [This seems to be very like **V. carnosula,** Hk. f.—*N. E. B.*]

Vitis Berlandieri, Planch. (*B. T. O.* 1888, p. 156.) Ampelideæ. H. H. or G. Vine with pentagonal stems, covered with a crisp floccose pubescence; cordate-orbicular, more or less 3-lobed, toothed l.; and panicles of blackish-violet globose berries. Texas, New Mexico.

Vitis indivisa, Willd. (*G. and F.* 1888, v. 1, p. 297.) H. an ornamental climber, suitable for covering trelisses or walls. L. cordate, serrate, 4–5 in. long. Fl. in small loose panicles. Berries about the size of a pea. Eastern North America.

Vitis reniformis, var. **violacea,** Carr. (*R. H.* 1888, p. 536, f. 132.) H. diœcious vine, with very long slender stems. L. large, roundish-reniform, obtuse, crenulate, dark green above paler beneath, strong reticulate, the petiole and veins cottony-hairy. Male fl. in small panicles, on slender dark red peduncles. China.

Vitis Romaneti, Carr. (*R. H.* 1888, p. 536 p. 131.) H. diœcious Vine. L. very variable, cordate to 5-lobed, acute, toothed, bright green above, silvery white beneath. Male flowers in freely produced, compact panicles. China.

Vriesea fulgida, Duval. (*Ill. H.* v. 35, p. 87, pl. 67.) Bromeliaceæ. Garden hybrid.

Vriesea imperialis, Carr. (*R. H.* 1888, p. 58.) A noble Bromeliad, with a very stout stem, about 18 and 20 in. thick, bearing a rosette 4½ ft. in diam., of bright green l., which are ascending and slightly recurved, channelled down the face, narrowed gradually from the base to the spine-pointed apex. Fl. unknown. Brazil. [According to Mr. Baker this is one of the many forms of **Tillandsia regina,** Vell. —*N. E. B.*]

Vriesea pulverulenta var. **lineata,** Carr. (*R. H.* 1888, p. 89, f. 20; and *W. G.* 1888, p. 156.) A grand and very ornamental plant, the rosette of l. measuring 6–7 ft. in diam. L. ascending with recurved tips, gradually narrowing from a very broad base to the acute apex; green, with a powdery meal; and longitudinally striped with yellow. Fl. unknown. Brazil.

Vriesea Wittmackiana, Kittel. (*Gfl.* 1888, pp. 287 and 553, t. 1283; *G. C.* 1888, v. 4, p. 565; and *H. G.* 1888, p. 554.) Garden hybrid.

Warrea bidentata, Lindl. (*G. C.* 1888, v. 3, p. 104.) Orchideæ. Allied to *W. tricolor*, but with a longer and narrower lip, having a sharp basal keel, and the disk covered with seriate callosities.

Zinnia linearis, Benth. (*G. and F.* 1888, p. 270.) Compositæ. H. annual. A pretty little species, of dwarf bushy habit, with linear or linear-lanceolate l., and bright orange-yellow fl. Mexico.

Zygopetalum, brachypetalum, var. **stenopetalum,** Regel. (*Gfl.* 1888, p. 384, t. 1277; and *H. G.* 1888, p. 401.) Orchideæ. A variety with narrow acute sep. and pet. of a purple-brown, marked with green. Lip. violaceous with a whitish margin; the basal crest with about 5 crenations.

Zygopetalum citrinum, Nicholson. (*G. C.* 1888, v. 4., p. 94.) This is *Promenæa citrina*, Don, now referred to *Zygopetalum*.

Zygopetalum hemixanthum, Rchb. f. (*G. C.* 1888, v. 4, p. 206.) Allied to *Z. Lalindei*, but distinct in colour, and with numerous tubercles and processes at the base of the crest of keels. Sep. and pet. white. Lip yellow, the crest darker. *Syn. Bolleæ hemixantha*, Rchb. f. New Granada.

Zygopetalum Sanderianum, Regel. (*Gfl.* 1883, p. 657, t. 1287.) A distinct looking plant, with a slender creeping stem, bearing ovoid bulbs at distant intervals. L. lanceolate acute. Scape few flowered. Sep. and pet. lanceolate acute, green, speckled with brown at the base. Lip obovate, very obtuse, slightly crenate, with a triangular, crenate crest at the base, blue-purple.

Zygopetalum Wendlandi, Rchb. f. (*Gfl.* 1888, p. 105, t. 1267; *G. C.* 1888, v. 4, p. 509; *H. G.* 1888, p. 175; and *R.* v. 2, p. 9, t. 53.) A fine species, with narrow lanceolate acute l., and solitary fl. about 2½ in. in expanse, on scapes 3–4 in. long. Sep. and pet. lanceolate acute, undulately curved, light greenish. Lip angled at the base on each side, constricted at the middle, then expanded into a large cordate-reniform, wavy front lobe, which is strongly revolute at the tip; white, with the semicircular, many-rayed crest at the base, and the disk in front of it violaceous. Syn. *Bollea Wendlandiana* (*G. and F.* 1888, v. 1, p. 315.) Costa Rica.

M. [illegible] del.

[illegible]

Delphinium Zalil.

Aitch & Hems

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ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 29.] **MAY.** **[1889.**

XCII.—PERSIAN ZALIL.

(*Delphinium Zalil*, Aitchison and Hemsley.)

With Plate.

The following interesting account of the Persian dye plant *Zalil* has been prepared by Sir Joseph Hooker for the April number [tab. 7049] of the *Botanical Magazine.* The plant was first described [Transactions of the Linnean Society, ser. 2, vol. iii., p. 30, t. 3] in the report "on the Botany of the Afghan Delimitation Commission," which was worked up at Kew from the remarkable collections made by Surgeon-Major Aitchison, C.I.E., F.R.S., when on duty as naturalist attached to the mission.

The Zalil flowered at Kew in July of last year, and specimens of the flowers as used for dyeing purposes and for medicine are in the Museums of Economic Botany. By the courtesy of Messrs. Lovell, Reeve, and Co. a reproduction of the drawing of the plant is included here with the description :—

" As a plant of economic value this is one of the most interesting discoveries of the Afghan Delimitation Commission, and our knowledge

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of it is due to the fact that the Indian Government directed a competent botanist, Dr. Aitchison, F.R.S., to accompany that important geographical operation. In the work cited above Dr. Aitchison (p. 31) thus describes the Persian Zalil, 'This plant forms a great portion of 'the herbage of the rolling downs of the Badghis, in the vicinity of 'Gulran it was of great abundance, and when in blossom gave a 'wondrous golden hue to the pastures. In many localities in Khorasan 'above 3,000 feet it is equally common. The flowers are collected 'largely for exportation, chiefly to Persia, for dyeing silk; they are 'also exported from Herat, through Afghanistan to Northern India, to 'be employed as a dye, as well as to be used in medicine.' In another place (p. 20) Dr. Aitchison, speaking of the vegetation of Badghis, says, 'For a short period the hillocks are tinted an exquisite blue by the 'flowers of *Gentiana Olivieri*, which is, as Boissier noted, a hot country 'Gentian. This is followed by *Delphinum Zalil*, a perennial, which 'throws up a spike of bright yellow blossom, two feet in height. Its 'showy blossoms suddenly cover the downs, which they illuminate with 'their brilliant colouring, affording a sight never to be forgotten.'

"The fact of *D. Zalil* affording a dye stuff is one of the many evidences of our ignorance of the materials used in the industrial arts of the East. It is reasonable to suppose that the flowers have been an article of commerce for ages, and yet I am unable to find any allusion to the subject in books devoted to the Economic Botany of India or to its manufactures. It is to be hoped that this may meet the eye of some intelligent official in the British Indian service who might ascertain to what purpose the important Zalil is put.

D. Zalil does not accord well with any section of *Delphinastrum*, as these are defined by Boissier. Regel, who was consulted as to its affinity, and whose knowledge of Oriental plants is unquestioned, pronounced it to be possibly *D. ochroleucum*, a Soongarian species, reduced by Boissier (vol. i., p. 89) to a form of the polymorphous *D. hybridum*, which has white, blue, and scarlet flowers; but that species belongs to the division with a dilated base of the petiole, with the lower petals equalling or exceeding the sepals, and with other discordant characters; yet I know no nearer affinity.—J. D. Hooker."

Figs. 1 and 2, petals; Fig. 3, carpels; all enlarged.

XCIII.—TASMANIAN WOODS.

The Colony of Tasmania was not represented at the Colonial and Indian Exhibition held in London in 1886, and hence there is no mention made of its products in the Reports prepared for the Royal Commission.

It was felt that as regards the timbers of Tasmania, as well as its numerous other natural products, this was a distinct loss to the Colony. Recently an effort was made to send to this country and submit to a practical test the most promising of Tasmanian woods on the same lines as the tests applied to the woods shown at the Colonial and Indian Exhibition. These tests were undertaken by Mr. Allen Ransome of Chelsea, who has prepared the following Report, which has been kindly communicated to Kew by the courtesy of Mr. E. N. C. Braddon, Agent-General for Tasmania, for publication in the *Bulletin*.

The woods of Tasmania are for the most part represented by fine specimens in the Timber Museum of the Royal Gardens (Museum No. III.).

Mr. A. Ransome to Agent-General for Tasmania.

Sir, Chelsea, November 23rd, 1888.

I thank you for your letter of the 1st instant, giving me a list of the Tasmanian woods forwarded to Stanley Works for trial some time since, and have now the pleasure to enclose my report on the same.

I regret that from the very unseasoned state of the timber when it first arrived it was impossible to prepare my report sooner, as it was necessary, in order that the trials might have any practical value, that the woods should be in a properly workable condition, and although in order to save time I had the samples seasoned by the cool-air drying process, it was several months before they were fit for experiment.

I have sent with my report a short piece of board planed by machinery from each of the samples submitted for trial, but regret that these did not include several of the better Tasmanian woods, particularly the She-Oak, Silver Wattle, Figured Myrtle, Curly Gum, and Musk, as it is evident from the polished samples of these woods at your office that they would be valuable in the English market for cabinet work.

There can be no doubt, however, that your polished samples of Blackwood, Huon Pine, and Myrtle have been specially selected from the best figured logs, as neither of the three samples of these woods submitted to me for trial can at all compare with them in beauty of figure, and assuming that the samples you sent to me are fairly representative of their various kinds, it is certain that anyone ordering these woods in quantity from your polished samples would be greatly disappointed with the result.

I am, &c.,
(Signed) A. Ransome.

Report on certain Tasmanian Woods furnished by the Agent-General for Tasmania for trial by Mr. A. Ransome, Stanley Works, Chelsea.

Having carefully tested the various samples of Tasmanian timbers furnished to me for that purpose, I have pleasure in giving below the results of these trials.

The woods submitted for experiment included pieces of the following timbers:—

1. Stringy bark (*Eucalyptus obliqua*).
2. Stringy gum.
3. Red myrtle (*Fagus Cunninghamii*).
4. White myrtle (*Do. Do.*).
5. Pine (*Dacrydium Franklinii?*).
6. Huon pine (*Do. Do.*).
7. Blackwood (*Acacia melanoxylon*).
8. Lightwood (*Do. Do.*).
9. Pencil cedar (*Do. Do.*).
10. Sasafras (*Atherosperma moschata*).

All these samples without exception were so wet and unseasoned that it was necessary to dry them all artificially for some months before they were in a workable condition. This operation, which explains the delay in furnishing my report, has had the effect of rendering the woods about as dry as if they had been seasoned for three or four years by exposure to the air, and all the woods when the trials took place may therefore be considered as perfectly seasoned.

The trials embraced working the various samples with different joiners' machines, and included the operations of sawing, with circular, vertical, and hand saws; planing and moulding with revolving cutters; cutting circular mouldings, and making two or three bands from such of the woods as I thought might be suitable for cooperage work. Further trials were made with the object of testing the strength of each of the woods, the result of which is given at the end of this report. For this purpose pieces 1 inch square by 30 inches long, having been selected from the straightest and soundest portions of each piece of timber, were placed horizontally across bearers exactly 2 feet apart, and weights hung upon the centre until each sample broke, and the deflection immediately before the breaking point was reached is also given in the table.

Planed samples of the various woods as left by the cutters of the planing machine accompany this report, by which it will be seen that they are all easily worked by machinery, and it is somewhat remarkable that notwithstanding the very wet condition of all these woods when first put into the drying chamber none of them cracked in the process of seasoning. Samples of each wood submitted to the breaking test are also sent to show the class of fracture in each case.

I assume that the samples submitted for trial may be taken as fair commercial specimens of the woods of their various kinds, but I think it well to point out that none of the Tasmanian woods I have treated exhibit the beautiful figure which is so strikingly apparent in the polished samples which I saw at your office.

Taking the samples in the order in which they are mentioned above I will now give the result of the trials in detail :—

Stringy bark (*Eucalyptus obliqua*), a very strong tough wood, with a straight grain, in appearance somewhat resembling American ash. From its great strength and toughness it is well adapted for carriage, cart, and waggon building, wheelwork, and agricultural machinery, as well as for the framing of railway carriages and trucks. It is also a valuable wood for the stronger description of building constructions, and would make excellent railway sleepers. From the peculiar strength of the fibre of the grain it will not maintain a good surface, as, even when perfectly dry, the grain rises, so as to render it impossible to polish it successfully.

Stringy Gum.—This wood bears a strong resemblance in general appearance and texture to the stringy bark last described, but the grain is crossed diagonally with long spots of a lighter shade, which would show a good figure if the wood could be polished. Stringy gum, however, is open to the same objection in this respect as stringy bark, but in a still more marked degree; for not only does the grain rise after the board is planed, but unless it is absolutely dry, fibres of the wood become detached from the surface, which renders this wood quite unfit for any but rough work.

Red Myrtle (*Fagus Cunninghamii*).—A sound, mild-working wood, of a bright pink colour, resembling English beech in grain, and could be used to advantage for all the purposes for which the best beech is employed in this country; while its superior appearance would enable it to take the place of the cheaper kinds of mahogany in wardrobes and other cabinet-work.

White Myrtle (*Fagus Cunninghamii*).—This wood closely resembles the Red Myrtle last described in texture and grain, but differs from it in colour, having a brownish-grey tint. Like the red myrtle, it could be used for all the purposes for which the best English beech is employed, but its somewhat dull and unattractive colour would preclude its being used as a substitute for mahogany.

Pine (*Dacrydium Franklinii?*).—This is a fine close-grained wood, resembling in appearance some of the descriptions of pine known in this market, but it is harder, heavier, and tougher than any of the woods of that description hitherto used in England. As from the sample submitted, it appears that the trees grow to a great size and the wood is very easy to work, it should be a favourable timber for building purposes; while its strength and toughness should make it well adapted for use in agricultural machines, and the sides and floorings of railway waggons and trucks. At the trials of the breaking strains given at the foot of this report, this wood stood a strain of 483 lbs., and the deflection before breaking was as much as 1 inch in 20 inches, which testifies a degree of strength and toughness most unusual to find in any wood of this class.

Huon Pine (*Dacrydium Franklinii*).—This is a beautifully sound and mild wood, of a light straw colour. As it is very easily worked, and frequently has a very ornamental grain, it is well adapted for first-class joinery work, making beautiful panels and mouldings, and the better figured logs should meet with a ready sale in this country for furniture and cabinet work. As it is somewhat brittle, and breaks under a comparatively small strain, it is not suitable for joists, beams, or the heavier descriptions of builders' work, and as it could not be imported into this country at a price which would compete with American pine, its sale in England would be limited.

Black Wood (*Acacia melanoxylon*).—A sound mild-working timber of a brownish colour, closely striped with streaks of various shades of a reddish brown, and frequently crossed by diagonal marks of a light golden colour. The more ornamental logs of this wood are exceedingly beautiful, and should fetch a high price in this market, where they could be used to advantage in place of the best Honduras mahogany, while the less ornamental logs would serve for the higher class of joinery work, such as counters and other shop fittings. The younger growth is well suited for cooperage work, and a barrel made from one of the pieces submitted for trial before being artificially seasoned is still quite tight, and shows no sign of shrinkage.

Light Wood (*Acacia melanoxylon*).—This is an inferior description of black wood, from which it differs mainly in being of a lighter colour, and having a somewhat more open grain. Although it will not compete with the black wood for highly ornamental cabinet work, it could be used in the place of cheap mahogany for wardrobe backs and other similar work.

Pencil Cedar (*Acacia melanoxylon*).—This, like the light wood last described, is very similar in grain and growth to the black wood, and the fact that the same Latin name of *Acacia melanoxylon* is common to this and to the two woods last described is sufficient evidence that they are varieties of the same tree. If pencil cedar could be imported into this country at a price that would enable it to compete with the cheaper descriptions of mahogany and cedar it would meet with a ready sale for the purposes for which these woods are now almost exclusively used.

Sasafras (*Atherosperma moschata*).—This is a light wood of no commercial value, and appears to be only suitable for the commoner descriptions of packing cases or for firewood. The brown marks which largely pervaded the piece sent for trial are, I think, due to decay, and are probably the result of the timber having been felled at the wrong season, or having been left too long on the ground after it had been felled. For the reason above named it would never pay to import sasafras into this country.

(Signed) A. Ransome.

23rd November 1888.

Table showing the result of the Breaking Trials of the Ten kinds of Tasmanian Timbers mentioned in the above Report.

No.	Name.	Dimensions of piece broken.	Distance between bearers.	Breaking Weight.	Deflection at Breaking Point.
		Inches.	Inches.	Lbs.	Inches.
1	Stringy Bark - -	30 by 1	24	602	$\frac{7}{8}$
2	Stringy Gum - -	Do.	Do.	336	1
3	Red Myrtle - -	Do.	Do.	452	$1\frac{7}{8}$
4	White „ - -	Do.	Do.	459	$1\frac{3}{8}$
5	Pine - - -	Do.	Do.	483	$1\frac{1}{2}$
6	Huon Pine - -	Do.	Do.	203	$1\frac{1}{4}$
7	Blackwood - -	Do.	Do.	518	$1\frac{3}{4}$
8	Lightwood - - -	Do.	Do.	378	$2\frac{1}{8}$
9	Pencil Cedar - -	Do.	Do.	476	$1\frac{7}{8}$
10	Sasafras - - -	Do.	Do.	280	1

XCIV.—LILY FLOWERS AND BULBS USED AS FOOD.

It is well known that in countries where lilies are indigenous and plentiful they are sometimes utilised as food plants. For some years the dried flowers of certain lilies have formed a considerable article of trade in China, and in the Consular Report on the trade of Chinkiang for the year 1886, p. 10, it is stated:—

"The export of lily flowers has increased from 7,033,000 lbs. to 7,677,622 lbs., and is the largest export for many years. The crop was a very good one, and prices were, during most of the year, remunerative. Not more than two-tenths is consumed here; the rest goes south, where it is used to flavour soup. The cultivation of this plant yearly increases in the north of this province."

In a letter addressed to Kew by Mr. Pelham L. Warren, Consul at Taiwan, dated August 16, 1883, the following information is given respecting the source of lily flowers used in China:—

"The lily flowers mentioned in Mr. Watter's Consular Report, concerning which you ask for information in your note of the 6th June last, are the dried blossoms of *Hemerocallis graminea* and *Lilium bulbiferum*. They are used by the Chinese for flavouring soups, and also eaten as a vegetable. Lily flowers are also said to be efficacious in pulmonary affections, and to have tonic properties. I enclose a small specimen of those imported here. Hankow is the chief place of export in China, and large quantities also come from Japan."

The specimen forwarded by Mr. Warren was evidently the flower of *Hemerocallis*, and Mr. Baker saw no reason why it should not be *H. graminea*, Andr. (H. minor, *Mill*) the Day Lily distinguished from the true lilies by its shortly trumpet-shaped perianth. There were no specimens of the flowers of *Lilium bulbiferum.*

Among the Japanese the lilies are much used for food, according to Professor Penhallow, who gives the following interesting account of their uses in the *American Naturalist*, vol. xvi., p. 119:—"Various " species of *Lilium* abound throughout the forests, and all those which " furnish a sufficiently large bulb are utilised as a source of farinaceous " food. Early in autumn the women may be seen returning to " their villages loaded with bulbs. These are thoroughly crushed in " a large wooden mortar, after which the starch is separated from the " cellular mass by repeated washing. The former is then hung up in " bags for winter use, while the latter is dried in round perforated " cakes, somewhat resembling miniature mill-stones, and hung up to " dry."

Efforts were made to procure specimens of lily cakes from Japan for the Museums of Economic Botany at Kew, and as shown in the following official correspondence not only lily cakes, but other specimens were obtained, which are now in the Kew Museums.

The HON. POWER LE POER TRENCH to FOREIGN OFFICE.

MY LORD, Tokio, March 6th, 1884.

SINCE the receipt of your Lordship's despatch, No. 100, of the 25th September last, I have been using my best endeavours to obtain for the Director of the Royal Gardens, Kew, specimens of the lily bulb cakes, said to be used as food by the Japanese, but in spite of all the inquiries I have made, I have been unable to find them either in Tokio or in Yokohama.

Mr. Woolley, however, who was passing through Yokohama in December last, on his way back to his post, undertook to inquire whether they were procurable in some town or village in the northern part of Japan, and the month before last he wrote that he could not find any in Hakodate, and that the Japanese there said they had never seen such things. He was inclined to think that Professor Penhallow had mistaken them for *Fu* cakes, which are made of wheat and hung up in shops for sale, and that those he referred to were only to be found in the Aino country. He had, however, written to a Mr. Brooks, a botanist attached to the Agricultural College at Sapporo, and had asked him to try and obtain some of the specimens required.

On the 1st instant I received a further letter from Mr. Woolley, saying that he had at last succeeded in obtaining the cakes asked for, and he forwarded me a small parcel containing a specimen of the smaller kind, the larger ones being, he said, of an awkward size for transport, and more likely to get broken.

I have now the honour to forward to your Lordship a box containing the four specimens of the cakes, together with a description of the same.

* * * * *

I have, &c.
The Earl Granville, K.G., (Signed) P. LE POER TRENCH.
&c. &c. &c.

[Enclosure.]

Description of specimens illustrative of the economic use of the bulbs of *Lilium cordifolium*: Uba-yuri (Japanese name), Kiu (Aino name), forwarded for the Museums of the Royal Gardens, Kew.

1. Fibre from which starch has been partially extracted.

After the bulbs have been well washed and soaked in water for two days and nights they are pounded in a wooden mortar, and then transferred to a tub filled with water. The mass is thoroughly kneaded with the hands, and allowed to stand for a night to enable the starch to settle, after which the cellular mass is taken out and dried.

2. Cakes made of the above fibre, by pounding it in a mortar with a little water, and then kneading the mass into shape with the hands. The cakes are hung up to dry in the Aino huts. The discolouration is caused by smoke. The cakes are not eaten by the Japanese. The Ainos boil and eat them either "*au naturel*" or mixed with rice. (The cakes vary in size, the large ones being over one foot in diameter).

3. Starch made by the Japanese from Uba-yuri bulbs. That made by the Ainos is similar but coarser.

4. Confectionery made by Japanese from Uba-yuri.

XCV.—P'U-ÊRH TEA.

A tea under this name appears as an article of commerce in the province of Yun-nan, in the south-west of China, near the boundaries of Burma and Siam. It is said to possess medicinal and invigorating properties, and to be specially used to aid digestion after heavy meals. A specimen of P'u-êrh tea was communicated to the Kew Museums by Mr. Lockhart in 1858, and another by Mr. John Fryer in 1879. Mr. Fryer states that "this tea is not to be purchased in any part of the east of "China. It is sent as a tribute to Pekin and can only be obtained "when brought by officials from Yun-nan. The tea is made up into "cakes of a lenticular shape about eight inches in diameter and well "pressed."

In a paper read before the Royal Geographical Society, by Mr. Colquhoun, November 13, 1882, it is mentioned that "the most "celebrated tea in China comes from a part of the Shan country, from "a district called I-Bang mainly, situated five days south of the Yun-nan "frontier. This tea, which by a misnomer is called P'u-êrh tea, from "the name of a prefecture close by, is sent to the town of Ssŭ-mao for "distribution. From that place it is forwarded to Pekin and the "northern provinces; by caravans to the Yangtsze, thence by river to "Shanghai, and from that port northwards."

In the same paper Mr. Colquhoun expresses the hope that British trade would some day tap the southern parts of Yun-nan, and that "this celebrated tea would become a staple article of export." Commenting on this latter statement, Mr. G. M. H. Playfair, then Her Majesty's Consul at Pakhoi, in a letter to Kew dated 20th February 1883, points

out "that Mr. Colquhoun was evidently under the impression that
" P'u-êrh tea is akin to the Souchongs and Boheas of the breakfast
" table but of superior quality, like the delicate growths reserved for
" Imperial use. This opinion is, however, erroneous. P'u-êrh tea is
" certainly celebrated, but not in that way. Although produced, as I
" understand, by a *Thea* its use is medicinal. The Chinese drink a cup
" of it after a heavy meal as a digestive; even two cups might perhaps
" be indulged in, but to take three would be productive of inconvenience,
" and four positively dangerous. I am of course merely quoting native
" opinion. This much appears certain, the article is not fitted for the
" breakfast table, and is not likely to be exported to foreign countries
" except as a drug, and never in large quantities."

The specimens of P'u-êrh tea in the Kew Museums consist of loose tea contributed by Mr. Lockhart in 1859, and of cake-tea or brick-tea contributed in 1879 by Mr. Fryer. In neither specimen do the leaves appear like ordinary tea in general character. They are made up of large and small leaves indiscriminately mixed together. Some are flat and broken, others are slightly curled, while only a few of the youngest leaves have the appearance of tea as seen in this country. In colour they are rusty-brown, changing to black according as the upper or lower side of the leaf is exposed. From the colour and the character of the decoction it is evident that they have undergone some process of fermentation, and they still retain some fragrance, although this has now only a faint resemblance to good commercial tea. A decoction obtained from the brick-tea presented by Mr. Fryer is of a bright rich colour, with a delicate aroma, but possessing a peculiar bitter flavor. It is possible that the Chinese value this tea on account of this bitterness. From an examination of the soaked leaves, which vary from 1 to 3 inches in length, there can be little doubt they are derived from some species of Camellia closely allied to the Assam tea *Camellia theifera*, Griff. The young leaves are copiously covered with tawny silky hairs, and these hairs are retained to some extent even in the larger leaves on the under side along the mid-rib and secondary veins.

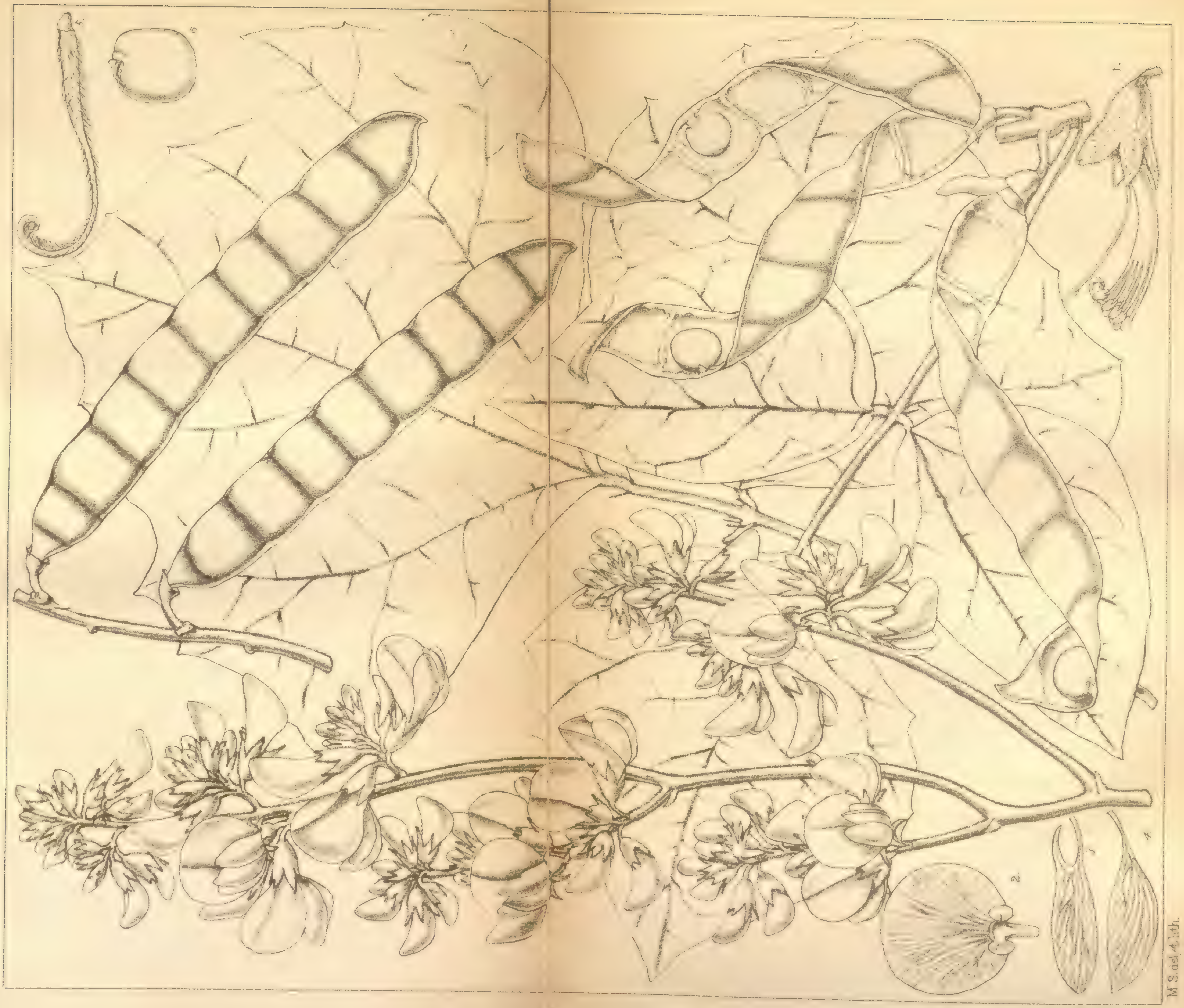
In general outline, as also in the character of the venation and in the serratures along the edge, the leaves are indistinguishable (except perhaps in the difference in colour between the upper and lower sides) from what might be expected from Assam tea treated in the same manner.

At present we have nothing but the leaves to go by. In the absence of flowers and fruit it is impossible to determine the plant yielding P'u-êrh tea. The indications at present are that it is very near if not identical with the wild Assam tea-plant. This, it must be remembered, would be unfamiliar to the Chinese, and hence it is natural to suppose that P'u-êrh tea is regarded by them as something distinct from the ordinary tea, and esteemed as a nervous stimulant and as an aid to digestion on account of its greater richness in theine, in the same way as the Bolivians use a decoction of Coca leaves.

From Mr. Colquhoun's description of the locality, it is clear that it does not grow in China, but is obtained from the Shan States of Siam, and chiefly from the neighbourhood of the town of I-Bang. It is called P'u-êrh tea merely because this is the first Chinese town at which it is received after crossing the Yun-nan frontier. These Shan States have never been fully explored, and it is probable that they contain numerous valuable plants not yet known to science. It will be remembered that the valuable Siam Benzoin, of the source of which we are still in doubt, is obtained, according to Captain Hicks, of Bangkok, "from the northern "Laos States, but grows luxuriantly in Suang-Rabang, and all along "the belt of mountains in this province." Suang-Rabang (or Luang-Phrabang) appears to be only a few days' journey south of I-Bang, whence P'u-êrh tea is obtained. Hence any traveller in this region who would give attention to the subject might be able to solve problems connected with two most interesting plants which have exercised the minds of botanists for the last 30 years.

This summary of information respecting P'u-êrh tea, which exhausts all that known of it at Kew, has been suggested by the steps lately taken by the Government of India to obtain seeds of the plant from China for experimental cultivation in various parts of India. The action of the Government of India appears to have been due in the first instance to a communication received by it from Her Majesty's Consul at Shanghai, forwarding a sample of "the famous P'u-êrh tea from the south of Yun-nan." This sample was divided between the Economic Museum at Calcutta and the Governments of Bengal, the Punjab, and the North-West Provinces. A resolution (No. 255, dated the 8th Sept. 1879) was placed on record by the Government of India deciding to ask the Consul at Shanghai to furnish further particulars in connexion with the growth and manufacture of P'u-êrh tea. The receipt of the sample was also communicated to the *Indian Tea Gazette* and *Indian Agriculturist*, and in the latter paper for October 1879 it is stated that this tea is "highly prized at the Court of Pekin, and is also esteemed by the Chinese generally for its invigorating properties."

Seed of P'u-êrh tea appears to have been sent from China to India on two occasions, and in each case the result, as far as can be gathered from official records, has been a failure. This was no doubt owing to the seeds having lost their vitality in the long journey from the Shan States to Shanghai and again from Shanghai to India. It is the common experience of planters that tea seed very soon loses its vitality. Seed kept even for a few weeks, unless packed in soil, becomes unsound and incapable of germination. An account of the last attempt to introduce seed of the P'u-êrh tea plant to Madras is given in the Proceedings of the Government of Madras, Revenue Department, No. 695, dated 1st October 1888. The further steps to be taken to obtain seeds and specimens of this plant may very well be attempted either through Bangkok, as the district in which P'u-êrh tea is found is tributary to Siam, or through the adjoining Shan States of Burma. At the same time, as already suggested to the India Office by Kew, it is very desirable and important to obtain more precise information and complete sets of specimens of leaves, flowers, and fruit of the Siam Benzoin, a plant which is known to exist, as shown in a preceding paragraph, within the same geographical area as P'u-êrh tea.


1.
2.
3.
4.
5.
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M.S. del. et lith.

Pachyrrhizus angulatus. Rch.

XCVI.—SHORT-PODDED YAM-BEAN.

(*Pachyrhizus angulatus*, Rich.)

With Plate.

In the *Kew Bulletin* for January last, p. 17, and again in the *Bulletin* for March last, p. 62 (with Plate), an account was given of the Yam-bean (*Pachyrhizus tuberosus*, Spreng.). This is a valuable economic plant, yielding tuberous edible roots as well as pods, which, served like French beans, are an admirable vegetable for use in tropical countries. Hitherto, the plant had been included under *Pachyrhizus angulatus*, Rich. It is a question how far really it may be distinct, but Professor Oliver is of opinion that it possesses such well-marked characteristics that it deserves a distinct name for cultural purposes, and it has been decided to retain for it the specific name originally given it by Lamarck and adopted by Sprengel.

In order to form a means of comparison between the two plants a figure of *Pachyrhizus angulatus*, Rich., prepared for the *Icones Plantarum*, is here reproduced by permission of the Bentham Trustees.

Pachyrhizus angulatus, Rich.; DC. Prod., ii., 402. Roots tuberous. Stem herbaceous twining, clothed with short hairs, sometimes smooth. Leaves pinnately three-foliolate with stipellate lobed leaflets, stipules deltoid or ovate-lanceolate short; leaflets large membranous hairy or glabrous distantly toothed, base of lateral leaflets strongly oblique, of the terminal leaflets broadly cuneate, stipels subulate. Racemes loose $\frac{1}{2}$–1 foot, often with short somewhat erect branches at the base, bracteoles setaceous. Calyx, five-lobed, hairy. Corolla, reddish or violet. Legume 3–5 inches long, 6–8 lines broad, deeply depressed between the seeds, somewhat hairy.

Widely cultivated in the tropics of both hemispheres, "probably of Central American origin," Bentham, in Martius, *Fl. Bras.* (*Papilionaceæ*), 199, Pl. 53.

A starch is made from the tubers of this plant, or the tubers when young are eaten as in the case of *P. tuberosus*. In Fiji, where the plant is known according to Seemann as Yaka or Wayaka, a tough fibre is obtained from the twining stems, used in making fishing nets.

In a recent letter received from Dr. Trimen, F.R.S., Director of the Botanic Gardens, Ceylon, to whom Kew is indebted for herbarium specimens of both species of Yam-bean, it is stated:—

"The ordinary *Pachyrhizus angulatus* (from Java) is now cropping profusely here. You will be interested to know that the pods of this cannot be well used as a vegetable like those of the West Indian species [*Pachyrhizus tuberosus*]. The pods are smaller and more hairy, and the coolies tell me that they cannot eat them in their curries without setting up a diarrhœa, due no doubt to the irritation of the hairs."

Fig. 1, calyx and stamens; 2, vexillum; 3, wing; and 4, keel-petal; 5, pistil; 6, seed. *Enlarged.*

XCVII.—LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India, and the Colonies, in Correspondence with Kew.

Royal Gardens, Kew:—

Director - - -	W. T. Thiselton Dyer, C.M.G., F.R.S., F.L.S.
Assistant Director - -	D. Morris, M.A., F.L.S.
Clerks - - - -	John Bliss and F. W. P. French.
Keeper of Herbarium and Library	Prof. Oliver, F.R.S.
Principal Assistant - -	J. G. Baker, F.R.S.
Mycologist - - -	Dr. M. C. Cooke, M.A., F.L.S.
Assistant for India - -	W. B. Hemsley, A.L.S.
Assistant - - -	N. E. Brown, A.L.S.
„ - - -	R. A. Rolfe, A.L.S.
„ - - -	C. H. Wright.
Attendant - - -	J. T. Jeffrey.
Curator of Museums - -	John R. Jackson, A.L.S.
Office Assistant - - -	J. M. Hillier.
Préparateur - - -	G. Badderley.
Curator of the Gardens -	George Nicholson, A.L.S.
Assistant Curator (Tropical Department).	William Watson.
Foremen:—	
Arboretum - - -	William Truelove.
Herbaceous Department -	Daniel Dewar.
Greenhouse and Ornamental Department.	F. Garrett.
Temperate House (Subtropical Department).	W. Bean.

Bangalore.—Government Botanic Gardens, Lal Bagh:—

	Superintendent -	Mr. John Cameron, F.L.S.

Barbados.—Dod's Reformatory, Botanical Station:—

	Superintendent -	Mr. J. R. Bovill.

Bombay.—Horticultural Gardens and Parks:—

Oodeypore - -	Superintendent -	Mr. T. H. Storey.
Poona (Ghorpuri)	„ -	Mr. W. Shearer.
	Lecturer on Botany, College of Science.	Mr. E. M. Woodrow.

Bombay.—Municipal Garden:—

	Superintendent -	Mr. G. Sarstensen.

British Guiana.—Botanic Gardens :—

Georgetown	Superintendent and Government Botanist.	Mr. G. S. Jenman, F.L.S.
	Head Gardener	Mr. J. Waby.
	Second ,,	Mr. R. Ward.
Berbice	Keeper	Mr. Richard Hunt.

Calcutta.—Royal Botanic Gardens Department :—

	Superintendent	Dr. George King, LL.D., F.R.S., F.L.S.
Seebpore	Curator of Herbarium	Dr. David Prain, F.L.S., F.R.S.E.
	,, Garden	Mr. W. McHardy.
	Assistant	Mr. R. L. Proudlock.
Mungpoo	Superintendent, Government Cinchona Plantations.	Dr. George King, LL.D., F.R.S., F.L.S.
	Resident Manager	Mr. J. A. Gammie.
	1st Assistant	Mr. R. Pantling.
	2nd ,,	Mr. J. Parkes.
	3rd ,,	Mr. G. Gammie.
Darjeeling	Curator, Lloyd Botanic Garden.	Mr. W. A. Kennedy.

Cambridge.—University Botanic Gardens :—

	Professor	Charles C. Babington, F.R.S., F.L.S.
	Secretary to Botanic Garden Syndicate.	Dr. Francis Darwin, F.R.S., F.L.S.
	Curator	Mr. R. Irwin Lynch, A.L.S.

Canada :—

Ottawa	Dominion Botanist	Prof. John Macoun, F.R.S.C., F.L.S.
	Director of Government Experimental Farms.	Prof. Wm. Saunders, F.R.S.C., F.L.S.
Montreal	Director, Botanic Garden.	Prof. Penhallow, B.Sc.

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	Head Gardener	Mr. H. J. Chalwin.
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Mitenhage	,,	Mr. H. Fairey.

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	Clerk and Foreman	Mr. J. A. Ferdinandus.
	Draughtsman	Mr. W. de Alwis.
Hakgala	Superintendent	Mr. W. Nock.
	Clerk and Foreman	Mr. H. M. Alwis.
Henaratgoda	Conductor	Mr. A. de Zoysa, Muhandiram.
Anuràdhapura	,,	Mr. T. de Silva, Arachchi.
Badulla	,,	Mr. D. Guneratne.

Dominica.—Botanical Station :—

Curator (temporary)	Mr. J. Hartley.

Dublin.—Glasnevin Botanic Gardens :—

Scientific Superintendent.	Dr. McNab, F.L.S.
Curator	F. W. Moore, Cor. Mem. R.H.S.

Trinity College Botanic Gardens :—

Professor	Dr. E. Perceval Wright, F.L.S., Sec. R.I.A.
Curator	Mr. F. W. Burbidge, F.L.S.

Edinburgh.—University Botanic Garden :—

Professor	Dr. Isaac Bayley Balfour, F.R.S., F.L.S.
Curator	Mr. Robert Lindsay, F.R.H.S.

Fiji.—Botanic Station :—

H. E. Sir John B. Thurston, K.C.M.G.

Glasgow.—University Botanic Gardens :—

Professor	Dr. F. O. Bower, F.L.S.
Curator	Robert Bullen, Cor. Mem. R.H.S.

Gold Coast.—Botanic Station :—

Curator	—

Grenada.—Botanical Garden :—

Curator	Mr. Wm. Elliott.

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Cinchona (Hill) Garden.	,,	Vacant.
Kingston Parade Garden.	,,	Mr. W. Campbell.
King's House Garden.	,,	Mr. E. Campbell.
Bath	Overseer	Mr. W. Groves.

Lagos.—Botanical Station :—

	Superintendent	Mr. James McNair.

Madras.—Botanical Department :—

Ootacamund	Government Botanist and Director of the Government Cinchona Plantations.	Mr. M. A. Lawson, M.A., F.L.S.
	Curator	Mr. A. Jamieson.

Madras.—Agri Horticultural Society :—

	Secretary	Sir Chas. Lawson.
	Superintendent	Mr. F. M. Gleeson.

Malta.—Botanical Garden :—

	Director	Dr. Gulia.

Mauritius.—Department of Forests and Botanical Gardens :—

Pamplemousses	Director	Mr. John Horne, F.L.S.
	Assistant	Mr. Wm. Scott.
Curepipe	Overseer.	—

Natal.—Botanic Gardens :—

Durban	Curator	Mr. John Medley Wood, A.L.S.
Pietermaritzburg	,,	Mr. R. W. Adlam.

New South Wales.—Botanic Gardens :—

Sydney	Director	Mr. Charles Moore, F.L.S.

New Zealand :—

Wellington.—Colonial Botanic Garden :—

	Director	Sir James Hector, K.C.M.G., F.R.S.
Auckland	Curator, Domain Garden.	Mr. Wm. Goldie.

Niger Territories.—Botanical Garden :—

Asaba	Head Gardener	Mr. Geo. Woodruff.

Northern India.—Botanical Department :—

Saharunpur	Director	Mr. J. F. Duthie, B.A., F.L.S.
	Superintendent of Garden.	Mr. W. Gollan.
Lucknow	Superintendent	Mr. M. Ridley.
Cawnpore	Assistant Director in charge of Experimental Station.	Sayyed Mahammad Husain.

Oxford.—University Botanic Garden :—

	Professor	Dr. Sydney H. Vines, F.R.S., F.L.S.
	Curator	Mr. William Baker.

Queensland.—Botanic Gardens :—

Brisbane	Colonial Botanist	Mr. F. M. Bailey, F.L.S.
	Head Gardener	—
	Overseer	Mr. J. Cameron.
Acclimatization Society's Gardens	Secretary and Manager	Mr. Wm. Soutter.
Rockhampton	Superintendent	Mr. J. S. Edgar.

St. Lucia.—Botanical Station :—

	Curator	Mr. John Gray.

South Australia.—Botanic Gardens :—

Adelaide	Director	Dr. Schomburgk, Ph.D.
Port Darwin	Curator	Mr. Maurice Holtze.

Straits Settlements.—Gardens and Forest Department :—

Singapore	Director	Mr. H. N. Ridley, M.A., F.L.S.
	Head Gardener	Mr. Walter Fox.
Penang	Assistant Superintendent.	Mr. C. Curtis.
Malacca	„	Mr. R. Derry.

Tasmania.—Botanical Gardens :—

Hobart Town	Superintendent	Mr. F. Abbott.

Trinidad.—Royal Botanical Gardens :—

	Superintendent	Mr. John H. Hart, F.L.S.
	Assistant	Mr. W. E. Broadway.

Victoria :—

	Government Botanist	Baron Sir F. von Mueller, F.R.S., K.C.M.G.

Melbourne.—Botanical Gardens :—

	Director	Mr. W. R. Guilfoyle, F.L.S.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 30.] JUNE. [1889.

XCVIII.—JAMAICA COGWOOD.

(*Zizyphus Chloroxylon*, Oliv.)

With Plate.

The cogwood in Jamaica has long been known as one of the most valuable timber trees in the Island. In the early days of sugar and coffee planting cogwood was everywhere in demand for framing for mills and for cog-wheels. It was also known as being very durable in water. It was a tough, hard, and ponderous wood, and sought to be used on all occasions where strength and durability were required. It is probable, owing to the valuable character of the wood, that trees of large size became comparatively scarce, and at the present time such trees are only to be found in remote districts beyond the reach of roads and railways. Our interest at present is not so much connected with the value of cogwood as a timber tree but with its botanical determination. Although known for so long a period it is remarkable that until now the flowers and fruit of Jamaica cogwood had not been received in this

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1889.

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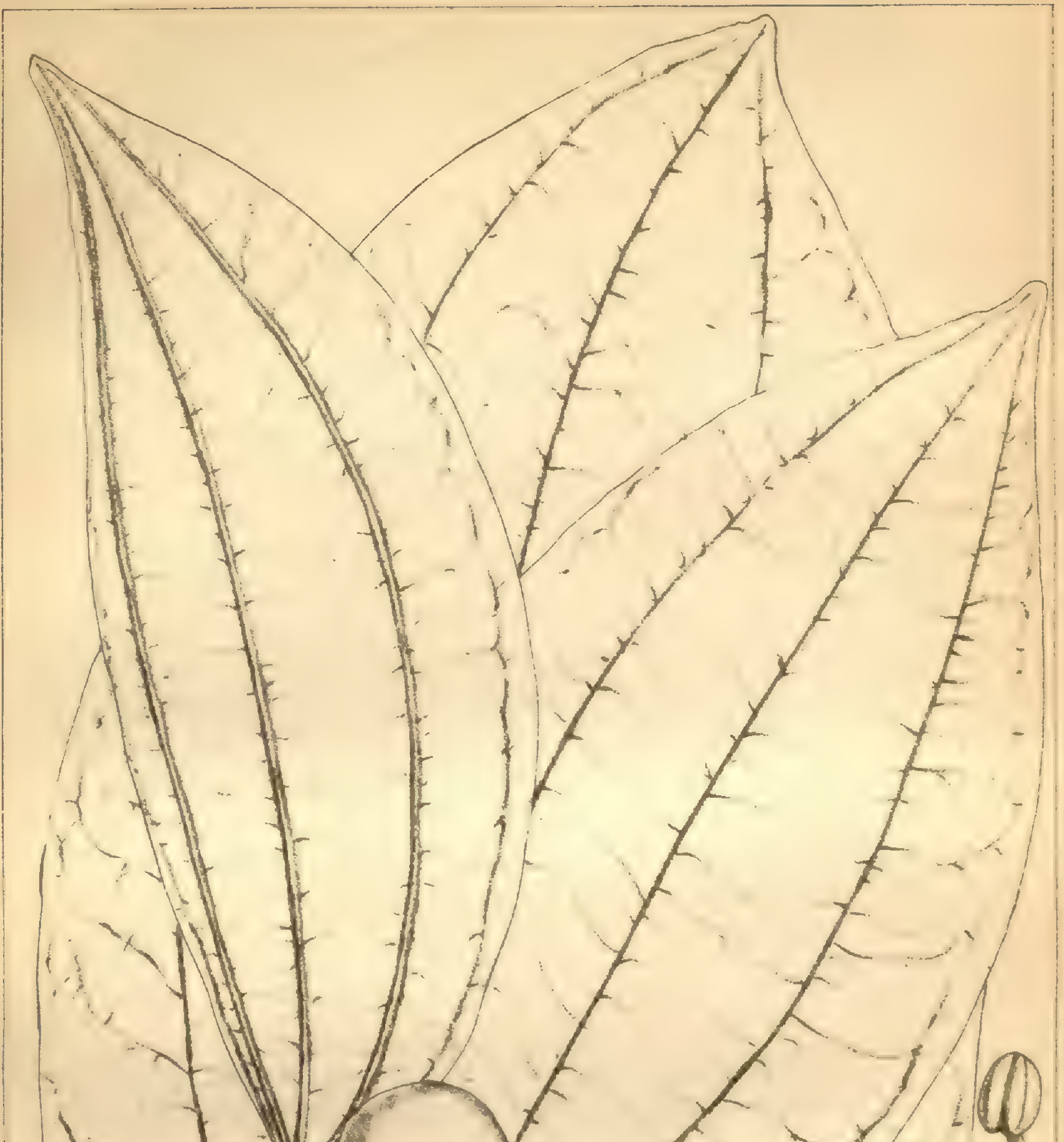
country, consequently the position of the plant in botanical classification had been left in doubt. It is true that Sloane (1696–1725) both mentions the plant and figures it (vol. ii., p. 85, t. 197, fig. 1). Patrick Browne (1756) refers to it as cogwood or green heart. He calls it *Laurus Chloroxylon*, L., and gives a tolerably good figure of the leaves and fruit (p. 187, t. 7, fig. 1). He adds, "It is common in many parts " of the mountains, and rises by a strong branched trunk to a very considerable height. The inward bark is of a light blood colour, and " incloses a strong greenish timber within the sap. The leaves are " smooth, of an oval form, and adorned with three considerable arched " veins each; they resemble those of the camphire tree both in shape, " size, and texture. This tree bears its fruit, which seldom exceeds a " hazel nut in size, scattered up and down upon the branches. The " wood is very tough, hard (and ponderous), and observed to answer " better than any other sort for the cogs used in rollers of sugar " mills, and generally esteemed one of the best timber woods of the " Island, and used on all occasions where strength and durability are " required."

At the time of the compilation of the *Flora of the British West India Islands* by Dr. Grisebach in 1864 this plant was known not to be a Laurus, but its exact position was still undetermined. In a note (l. c., p. 285), Grisebach states, "*Laurus Chloroxylon*, L. (Sl. t. 197, " f. 1; Br. Jam. t. 7. f. 1), a valuable timber-tree in Jamaica, from the " figures quoted is no *Laurinæa*. Upon Nees's authority it belongs to " the *Celestrineæ* (*Ceanothus Chloroxylon*, Ns.), but was omitted in " that order as a doubtful plant. My specimens are mere leaf branches, " which from their 3-nerved leaves had been compared with " *Cinnamomum*, though they are alternate and stipulate."

For the last 10 years efforts have been made by the Botanical Department, Jamacia, to procure good herbarium specimens, embracing flowers and fruit, of cogwood. Owing however to the scarcity of trees of large size, this has been a work of considerable difficulty. At last good specimens have been received at Kew through Mr. W. Fawcett, F.L.S., Director of Public Gardens and Plantations, Jamacia, who writes as follows: "I am at last sending you full material of cogwood. " I am sorry that I have not been able to get it before, but I have had " several people all over the country looking out for it, and have only " now obtained satisfactory material, which I at once despatch. I am " indebted to Dr. Dewar and Mr. George Douet for these specimens. " I suppose the reason why it has been so difficult to get specimens " is that the flowers are minute, and the fruit small and green. It is " probable also that only high trees flower."

From the material received from Mr. Fawcett, Professor Oliver has determined the cogwood to be a species of *Zizyphus*, a genus not previously recorded from Jamaica. *Zizyphus* is the Jujube or Lotus genus of *Rhamneæ*, and the fruits of several species, such as *Z. vulgaris* and *Z. Jujuba*, have an agreeable flavour, and are commonly eaten. A description of cogwood with a plate has been prepared for the *Icones Plantarum*, and by the courtesy of the Bentham Trustees a reproduction of the latter is included here with the description:—

Zizyphus Chloroxylon, Oliver (in Hook. Ic. Plant. Pl. 1862, *ined.*). An unarmed tree, with wide-spreading branches. Leaves alternate, ovate or ovate-elliptical, pointed, triple-nerved, the nerves extending to the apex, 4 to 7 inches long, $1\frac{3}{4}$–4 inches wide, quite entire, smooth, nerves beneath prominent, petioles $\frac{1}{3}$–$\frac{1}{2}$ inch long.



M.S. del, et lith.

Zizyphus Chloroxylon, Oliv.

Cymes many flowered, corymbose, the peduncle short, pedicels equalling the flowers. Flower-buds rusty-puberulous. Calyx lobes five, spreading, ovate-deltoid, bifoveolate, fleshy, conspicuously keeled on the inner face. Petals none. Filaments as long as the anther. Style three lobed at the top. Fruit subglobose, smooth, one seeded, 8 to 10 lines in diameter. Pericarp crustaceous. Seeds roundish, cotyledons plano-convex. Radicle inferior.—*Ceanothus Chloroxylon*, Nees Syst. Laur. p. 66. *Laurus Chloroxylon*, L. Sp. Pl. Ed. ii., p. 528.—Jamaica in the interior mountains, moderately common.

There is only one small specimen of the Jamaica cogwood in the Kew Museums, and this was obtained from the Paris Exhibition, 1855. It is labelled the "best wood for mill framing and cogwheels, very durable in water." In this specimen the heart wood is developed only to a small extent, occupying in fact only the central core about 3 inches in diameter out of a total diameter of about 9 inches. To procure serviceable heart wood of the characteristic colour, texture, and weight, it is probable the trees must be allowed to attain considerable age and size. The value of the timber is unquestioned, and in any system for the conservation of forests, and replanting denuded areas that may be adopted in Jamaica, the cogwood will no doubt receive, as it deserves, special consideration. So far as can be gathered this valuable tree is entirely confined to Jamaica.

FIG. 1. Expanded flower. 2. Calyx lobes. 3. Stamens. 4. Ovary (calyx segments removed). 5 Same, vertical section. 6. Tranverse section of fruit. *Excepting Fig. 6, all enlarged.*

XCIX.—COCOA-NUT COIR FROM LAGOS.

As may be gathered from the reports published in the *Kew Bulletin* (1888, p. 149, and 1889, p. 69), Governor Moloney has organised very extensive nurseries in different parts of the Colony of Lagos for the purpose of extending the cultivation of the cocoa-nut palm. Plantations consisting of 30,000 trees have already been established by the Government, whilst seedlings in large quantities are supplied at low rates to private persons with the view of making the industry as general as possible. In this work the recently established Botanic Station is actively engaged, as also the Government organisations attached to the Commissionerships of the Eastern and Western Districts, and of Palma. With the view of utilising to the best advantage the produce of these cocoa-nut plantations, when in full bearing, Governor Moloney has recently prepared experimentally some samples of cocoa-nut fibre so that an opinion might be obtained as to its value in this country. This West African coir was sent to Kew, and very interesting particulars respecting it are contained in the following correspondence:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 2nd February 1889.

I AM directed by Lord Knutsford to transmit to you a copy of a despatch which he has received from the Governor of Lagos reporting that he had despatched a bale of [cocoa-nut] coir to Kew.

2. His Lordship will be much obliged if you will kindly furnish him with your opinion on the specimen forwarded.

I am, &c.
(Signed) R. H. MEADE.

The Director, Royal Gardens, Kew.

[Enclosure.]

GOVERNOR MOLONEY to LORD KNUTSFORD.

Government House, Lagos,
23rd December 1888.

MY LORD,

AT the Colonial Exhibition of 1886 I was given to understand that the natural colour of Lagos coir had, in the opinion of brush and mat manufacturers (I may mention Messrs. Treloar, of Ludgate Hill), a special advantage which should command for it a ready demand and a comparatively high price, if it could be put regularly and in sufficient quantity on the English markets.

2. Accordingly, and in anticipation of the later development of a local manufacture for export of cocoa-nut oil, for which I entertain the opinion that the present annual crop of fruit offers a sufficient encouragement, I have had prepared by prison labour in the gaol of Lagos a bale of coir weighing 42 lbs.

3. This return represents the yield of 400 cocoa-nuts, the average present price of which is at the rate of 2*s.* 6*d.* per hundred.

4. The bale has been addressed to the Royal Gardens, Kew, and sent through the Crown Agents for the Colonies.

5. It is now my duty to request that your Lordship will be good enough to invite the co-operation of the Director of the Royal Gardens and obtain an authoritative opinion on the specimen forwarded.

I have, &c.
(Signed) ALFRED MOLONEY.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 21st February 1889.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 2nd instant, forwarding a copy of a despatch from the Governor of Lagos on the subject of a specimen of cocoa-nut coir which he had forwarded to Kew for an opinion as to its merits.

2. The specimen, consisting of a bale weighing 42 pounds, was duly received from the Crown Agents on the 11th ultimo. Samples were prepared and submitted to respectable brokers and dealers in the city, with a request that they would report upon the value of Lagos coir as compared with other coirs now in the London market.

3. The result of the inquiry is contained in the accompanying papers. It would appear in the first place that it is necessary to separate coir fibre, as yielded by the cocoa-nut, into two classes, namely, "bristle" fibre and "mat" fibre. The former is usually sold at about 30*l.* per ton, and the latter at about 10*l.* per ton.

4. The sample from Lagos contained these two fibres mixed together, and hence it was not presented in a state suitable for sale in this country. It is evident that Lagos fibre possesses no particular merit on account of its colour, but on the other hand, in Messrs. Harrison and Johnson's Report, it is stated to be "of very good length, which increases its value."

5. Although these reports are not so encouraging as Captain Moloney was led to suppose from the specimens exhibited at the late Colonial and Indian Exhibition, they furnish useful hints as regards the character of coir fibre necessary to command ready sale in this country.

6. With the view of further assisting in this direction, Mr. Thiselton Dyer has caused the specimens of Ceylon "bristle" and Ceylon "mat," forwarded by Messrs. Ide and Christie, to be sent direct to Captain Moloney as samples of coir fibres, which are acceptable to the London buyers. Other samples of fibre are enclosed in the parcel for Captain Moloney, including "brush" fibre, "mat" fibre, and "rough stuffing" fibre, prepared by Messrs. Toye and Bromley from the crude Lagos coir.

I am, &c.
(Signed) D. Morris.

The Hon. R. H. Meade, C.B.

[Enclosure No. 1.]

Messrs. Ide and Christie to Royal Gardens, Kew.

Sir, 72, Mark Lane, London, E.C., 7th February 1889.

We are duly favoured with Mr. Jackson's letter of the 5th inst., and samples of coir from Lagos. These contain soft, half-prepared "bristle" fibre, used in the manufacture of brushes, mixed with short or "mat" fibre. Such a mixture is unfortunate, and detracts from the value of the samples, as the two kinds, being used for different purposes, have to be separated. In the Ceylon coir they are always kept apart, and for your guidance we send you specimens of Ceylon bristle, value 30*l.* per ton, and Ceylon mat, value 10*l.*

There is nothing either in the colour or other character of the Lagos fibre which would justify the expectation of its commanding a ready demand and high price, as the Governor of Lagos has been apparently led to believe. On the contrary, we value the "bristle" portion of your samples at 15*l.*, and the "mat" portion at 9*l.* to 10*l.* per ton.

We are, &c.
(Signed) Ide and Christie.

D. Morris, Esq., M.A., F.L.S.

[Enclosure No. 2.]

Messrs. Harrison and Johnson to Royal Gardens, Kew.

4, Catherine Court, Trinity Square, London, E.C.,
Sir, 7th February 1889.

We are in receipt of your favour of the 5th instant, and also the sample. The coir fibre you send is mixed half prepared brush and mat fibre. The former if separated would no doubt find buyers at about 15*l.* per ton, and the mat fibre would sell freely at 9*l.* to 10*l.* per ton.

There is one sample consisting entirely of mat fibre; this is clean and long and would sell well at about 11*l.* to 12*l.* per ton. If the brush fibre were properly combed out like sample we have sent you by post, it would readily fetch 28*l.* to 32*l.* per ton present market value. The samples of fibre you send are of very good length which increases the value.

We would suggest that a small sample shipment be made, you would then get a good idea of the value. It would be no use sending any fibre unless the mat and brush were kept separate.

If in future we can be of any help to you or to the Governor of Lagos in bringing this article before the trade we should be pleased if you would make use of us.

We are, &c.
(Signed) HARRISON AND JOHNSON.

[Enclosure No. 3.]

Messrs. TRELOAR AND SONS to ROYAL GARDENS, KEW.

68, 69, and 70, Ludgate Hill, E.C.,
9th February 1889.

SIR,

WE are in receipt of your letter of the 5th and of the sample of Lagos coir. In our opinion this is badly cleaned or dressed, and not so good for brush-making as the usual sort. It certainly has no special advantages for mat-making, and is not in our opinion calculated to command a high price here. We have seen better fibre sold at public auction for 22*s*. per cwt. in London.

We are, &c.
(Signed) TRELOAR AND SONS.

[Enclosure No. 4.]

Messrs. TOYE AND BROMLEY to ROYAL GARDENS, KEW.

116, Fenchurch Street, London, E.C.,
19th February 1889.

SIR,

WE confirm our letter of the 11th instant and now beg to hand you our report on the fibre samples you sent. We trust this will give you the information desired. Should you require any other point answered we shall be happy to do so.

We are, &c.
(Signed) TOYE AND BROMLEY.

REPORT.

This fibre would find a ready sale here both for brush and mat making purposes, but the two sorts should be kept separate. For brush-making the long fibre can only be used and should be kept straight, and tied in small bundles and then made up in bales weighing about 1 cwt. or 2 cwt. each. The other sort for mat-making should be towselled and packed up into bales. Practically speaking the mat fibre is the combings or short from the brush fibre. There is also in the sample sent us a stuffing of rough fibre in each of the small bundles; this should be avoided as it deteriorates the value considerably; but if this stuffing was separately packed it would also sell here. We consider the value of the three sorts, if made up in the way we have described, would be based on the *present* value of fibre as follows :—

Sample.
No. 1. Brush fibre at 29*l*. to 31*l*. per ton.
No. 2. Mat fibre at 18*l*. to 19*l*. per ton.
No. 3. Rough stuffing sort at 10*l*. to 11*l*. per ton.

We return a sample of each quality to show more clearly our meaning. The brush fibre, we suggest, should be tied up about the size of our sample No. 1. You will notice that we have taken your sample as received, and dressed it into the above three sorts, which your friends will find far more advantageous than sending it in the rough condition.

(Signed) TOYE AND BROMLEY.

C.—A WHEAT PEST IN CYPRUS.

The following preliminary Report upon a species of *Tineina*, an insect destructive to wheat crops in Cyprus, has been communicated for publication in the *Bulletin* by Mr. Arthur E. Shipley, F.L.S., Fellow and Lecturer of Christ College, Cambridge, and Lecturer on Entomology at the Indian Civil Engineering College, Cooper's Hill:—

I am indebted to Dr. Guillemard for the material upon which the following report has been drawn up. It consisted of four specimens of the moth, some of them unfortunately mutilated through an accident ; a considerable number of larvæ of various sizes ; and five specimens of pupæ, one of them formed in the leaf between the lower and upper epidermis, the others on pieces of course linen. There were also several pieces of leaf, containing between the upper and lower laminæ numerous roundish bodies which I at first thought might be eggs, but which turned out to be excreta containing fragments of undigested spiral vessels and sometimes chlorophyll grains. The whole of the material was preserved in spirit with the exception of one moth. The moth is known in Cyprus as the *Siriwil.*

Owing to the fragmentary condition of the moths, there was great difficulty in identifying them. Mr. Stainton, the great authority on the *Tineinæ*, has been good enough to examine the specimens and to inform me that he is disposed to refer the insect to the species *Œcophora temperatella* (Lederer) of which he has specimens from Beyrout and Lydia. This species was also found by the Rev. O. P. Cambridge widely distributed throughout Palestine.

Œ. temperatella has been described by Mr. Stainton in his work on "The Tineina of Syria and Asia Minor." The female he informs me by letter is described in the same work as a separate species, *Œ. fuscofasciata*, though he stated at the time that he was strongly disposed to think that it was the female of *Œ. temperatella.*

I subjoin Mr. Stainton's description of the species.—"Head and face " ochreous at the sides, black in the centre. Palpi long, recurved, " ochreous, the tip of the terminal joint dark grey. Thorax pale or " dark ochreous, concolorous with the anterior wings. Antennæ slender " dark grey somewhat serrated."

"Anterior wings shining ochreous, bright or rather pale and with a very faint greenish tinge; the surface is more or less scattered with grey scales ; cilia glossy, pale grey with a faint ochreous tinge."

"Posterior wings lanceolate, very narrow for an *Œcophora*, dark grey, with the cilia a little paler."

"The distance between the tips of the expanded wings is seven or eight lines."

The larvæ are of a yellowish brown colour, and consist of 12 well-marked segments behind the head. The head is encased in a covering of dark brown chitin, and two triangular patches of chitin of the same colour almost cover the dorsal aspect of the first or pro-thoracic segment. The most posterior segment also bears a single plate of chitin in the posterior half of its dorsum.

Each segment has on its dorsal surface a transverse groove dividing it into an anterior and a posterior half. The second and third thoracic segments are provided with more complicated folds. The anterior half of the abdominal segments bears a pair of brown spots dorsally, one each side of the middle line, and on each side are two more dots close together, one rather larger than the other. Below these the skin is rather more whitish than elsewhere and in this whitish patch just above the insertion of the legs is a conspicuous spot. This spot is only found in the fourth to the eleventh segments inclusive, and is probably the stigma, or opening of the breathing tubes. The posterior half of each segment has two dots, one each side of the middle line immediately behind the dorsal spots of the anterior half of the segment, but the side spots are absent.

On the ventral or under surface each segment has a row of 10 dots almost in the same transverse line, but some of them are absent in the thoracic segments which bear pro-legs.

A pair of true legs is borne on each of the thoracic segments, each limb being surrounded by four chitinous rings and terminating in a claw. The first ring which surrounds the base of the leg is incomplete externally.

The sixth, seventh, eighth, ninth, and twelfth segments bear pro-legs, the first four pairs are completely surrounded by hooks, the posterior and anal pair have hooks wanting on the posterior side.

The larvæ are also provided with long hairs, borne dorsally and laterally.

The oldest larvæ measured 8 mm.

One of the five pupæ which I received was situated between the upper and lower laminæ of a wheat leaf, the other four were on pieces of coarse linen. Each was surrounded by a very scanty web of silk which seemed to attach the last four to the cloth. The pupæ were 4–5 mm. long, of a yellowish colour, but ruddy on the dorsal surface. The wings and legs stand out clearly from the body. At the posterior end of each pupa was an irregular black mass apparently the last larval skin which had been cast off.

The question where the pupa is normally found is most important. Dr. Guillemard is of opinion that it is formed in or on the ground; he says, "When full-grown the caterpillar apparently descends to the " ground, only a few making the cocoon on the wheat leaf itself. Owing " to my experiments being carried on with barley grown in pots, I can" not say definitely where the cocoons are placed in the natural state, " but there should be no difficulty in finding them. What makes me " suspect that the larva descends is that my cocoons were all made on " the linen bags which were wrapped round the pot; . . . . the " pupa gives birth to the perfect insect in about a fortnight's time."

In Cyprus the natives have a theory that the *Siriwil* appears only every other year, but it is probable that this is founded upon inaccurate observations. When abundant rain falls in the spring the injury caused by the pest is almost neutralised, but if the rains fail the crops are practically ruined. Captain Young informs me by letter that in the district of Famagusta, which has an area of about 930 square miles, 27,060 donums* were injured. The amount of grain destroyed in this area was estimated at 55,760 bushels of wheat, and 13,940 bushels of barley.

With regard to the habits of the various species of *Œcophora*, the larva of *Œ. minutella* causes damage to nursery men by devouring dried seed, the larvæ of all the other British *Œcophoræ* probably live on decayed wood, so that it is somewhat surprising to find the larvæ of *Œ. temperatella* living on succulent leaves.

A species of Tineina, known as *Ochsenheimeria bisontella* (taurella) attacks wheat in Germany. It seems to have very much the same habits as *Œ. temperatella* the larva burrowing between the two laminæ of the leaves. The eggs of this species are deposited singly by the female on the wheat leaves. The insect passes the winter in the larval stage. Taschenberg, who describes this pest, states that no remedial measures are known for it.

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* An acre is almost equal to two donums.

At present with our imperfect knowledge of the life-history and habits of the *Siriwil*, it is impossible to suggest any means for combating the disease. I would, however, strongly urge upon all those interested in agriculture in Cyprus the importance of determining accurately the following three points :—

(i.) Where the pupa is normally found, whether in the plant or on or in the ground, &c., and the period which elapses before the moth appears.

(ii.) Where the eggs are laid, and whether singly or in clumps.

(iii.) In what stage the *Siriwil* passes the winter.

In conclusion, I wish to express my thanks to Captain Young, Commissioner at Famagusta, and to H. Thompson, Esq., Commissioner at Paphos, for information about the habits of the *Siriwil*; and to H. T. Stainton, Esq., F.R.S., and W. F. Blandford, Esq., for assistance in identifying the species.

CI.—PATCHOULI.

(*Pogostemon Patchouli*, var. *suavis*.)

Patchouli has already been the subject of notice in the *Kew Bulletin* (1888, p. 71 and p. 133). An interesting article on the *Cultivation and Curing of Patchouli and its Adulteration* has lately been contributed to the *Journal* of the Agricultural and Horticultural Society of India by Mr. L. Wray, junior, Curator of the Government Museum, Perak. As the information contained in this article may not be readily accessible in this country and in the Colonies, it has been thought desirable to reproduce it in the *Kew Bulletin* :—

The plant yielding the perfume known as patchouli is usually stated to be indigenous to the Malayan Peninsula, but this seems to be doubtful, as there appears to be no evidence that it has been met with in the jungle, except in places where it could be clearly traced to some old cultivation.

It is grown and much esteemed by the aboriginal tribes of Perak and Pahang, and this should be borne in mind when cases of its being found in out-of-the-way places are brought forward in support of its being a native of the Peninsula. I have met with it at an altitude of nearly 5,000 feet amongst the Sakais of the mountains at the source of the Pahang River, far away from any Malayan villages, also among the same people in the Bernam, Batang Padang, and Kinta Districts of Perak, and among the Semangs in Upper Perak and Selama.

The leaves are made into garlands and worn round the waist by the women, and bunches of them are often stuck into their bamboo earrings. I have also seen them mixed with other leaves and flowers and formed into ornamental bunches which are hung up and used in some sort of demon worship or propitiation.

The Sakais of Batang Padang call the plant *Boon kalif* ; and, as this is not a corruption or derivation of the Malayan name, it may point to its being known to them prior to their coming in contact with the Malays. The latter people call it *Poko nilam*. The word *nilam* means sapphire, therefore the translation would be sapphire plant.

Patchouli is a very shy flowerer, so much so that by the natives it is said never to flower; and Mr. Hardouin told me that though he had grown and bought it for the last 30 years, he had never seen or heard of such a thing as a flower or fruit. Mr. N. Cantley, in "Notes on Economic Plants," says: "Plants raised from seed are reported to grow "well, but to have no scent, but retain it when produced from cuttings. "I have not been able to verify these statements, but it is well known "that plants do sometimes play tricks of this kind—sandal-wood "frequently." If this report was obtained from native sources it probably only represents another way of saying that the plant hardly ever bears seed.

Many similar sayings exist in regard to other occurrences which are either very rare or do not occur at all. For instance, hidden treasure is said to be found beneath a flowering plant of lemon grass; and the nest of a certain bird (which does not build one) will render the finder of it invisible.

CULTIVATION.

The cultivation of patchouli is carried on almost exclusively by the Chinese in the Straits Settlements. They do not grow it on a large scale, but a man will plant a patch of perhaps half an acre, or an acre at a time.

The land is trenched and thrown up into long beds either 4 feet or 18 inches wide. The former width will take two rows of plants, and the latter only one. The plants are put 2 feet apart along the rows.

The planting should be done in the wet season, and the cuttings, which are about a foot long, require careful shading with leaves until rooted, or they will get withered and die, the plant being a delicate one, and very susceptible to the heat of the sun.

The first cutting of the crop is made in about six months after planting, by which time the patchouli will have reached a height of 2 to 3 feet, and two other cuttings are made from the same plants at intervals of about six months. At the end of this time the old roots are dug up, the land re-trenched and manured and fresh cuttings planted.

I could get no reliable information as to the yield per acre, nor the cost of cultivation, but it must be rather high, as the land has to be thrown up into beds, manured and carefully weeded, and the cuttings shaded, and, in the event of dry weather setting in before they are rooted, they have to be watered until established.

Both flat and hill lands are suitable to its cultivation, and it seems to flourish best under slight shade, but probably the production of oil is less in that grown under shade than in that grown out in the sun, though the yield of leaf would be greater.

I was told by a Chinese merchant, a dealer in patchouli, that it is often planted on new land between coffee, nutmegs, and other permanent crops, and that it pays all the expenses of clearing and planting, leaving the permanent crop as clear profit.

Of natural enemies patchouli seems to have a fair share. One was described to me as a beetle, but as the young leaves which it is said to attack are dwarfed and deformed rather than eaten, I am inclined to think it is a bug. The older leaves are very much attacked by some insects, probably caterpillars and some of the grasshoppers.

CURING AND PRICES.

The plants are cut down near the ground when they have reached a sufficient size, one stalk only being left to each bush. The patchouli is then laid out in the sun to dry in the daytime, and put under cover at night and on the approach of rain.

The time required to dry it varies with the weather, taking from four days to a week. When thoroughly dry it is done up into bales, and sold either to dealers in the leaves or to the distillers. In this state it fetches about $8 per pikul of 133⅓ pounds.

The dealers cut it up and separate a great quantity of the larger stalks, and, according to its freedom from these, it is classed as 1st, 2nd, or 3rd quality. The best consists of leaves only, and is valued at $30 to $32 per pikul; but owing to the labour involved, this quality hardly pays to prepare. The second quality is composed of leaves and young shoots with little of the heavier stalk, and ranges in price from $17 to $20 per pikul. The third quality contains less leaf and more stalk, and fetches about $14 per pikul.

The best quality of all would be produced by picking from the plants the leaves and tops of the young shoots, and drying these in the shade, but it is doubtful if it would pay. Prepared in this way 36 lbs. of green leaves produce 10 lbs. of dried patchouli. The per-centage of essential oil in shade-dried leaves is, as might be expected, higher than in those which have been exposed for many hours to the full heat of a tropical sun, which in this latitude often goes over 120° F.

ADULTERATION.

Large quantities of the leaves of a plant known by the Malayan name of *Ruku* are often mixed with patchouli. The botanical name of this plant is *Ocimum Basilicum*, L., *var. pilosum*, Benth.

I was told by Mr. Hardouin (the principal distiller of patchouli oil in the States) that recently a Chinaman bought the whole of the *Ruku* growing wild in a cocoanut plantation in Province Wellesley, and 700 pikuls of the dried herb were collected and taken to Penang, to be used for the adulteration of the more valuable patchouli. Mr. Hardouin says he always prefers to buy the plant just as it is cut, as then it is easy to see if it is adulterated or not, but if the leaves are bought it is very hard to detect the imposition.

The *Ruku* leaves are rather whiter and the stalks smaller and rounder. Seed vessels are often also mixed with them. The smell of the two herbs is quite different, but if the sample has been baled for some time, this would be imperceptible except as communicating a twang to the general odour of the sample.

The leaves of another plant are also often mixed with patchouli. This plant is called *perpulut* by the Malays, and is known botanically as *Urena lobata*. The leaves are when dried much like those of the herb it is used to adulterate, but, unlike it, they are scentless. *Perpulut* is a very common weed all over the Straits Settlements, and is to be had in any quantity for the trouble of collecting it.

MANUFACTURE OF THE OIL.

The dried patchouli is put into a large copper cylinder fitted with a perforated false bottom and mounted on trunnions. Through one of these steam enters from a boiler and is conducted by a tube beneath the false bottom. The remaining trunnion is also hollow, and the steam, after passing through the leaves, passes out by it and into a worm immersed in a tube of water in the ordinary way. The pressure of steam employed is about 10 pounds per square inch, but it varies with the size of the worm and the temperature of the water used to cool it.

One pikul of the dried patchouli, just as it is cut, yields from 24 to 30 ounces of essential oil, and a sample free from the heavier stalks yields about double that amount.

Mr. Hardouin says, that by an ordinary still not more than one-half of the oil can be extracted, the temperature I presume not being high enough to volatize the whole of it.

He also says that the green leaves yield little or no oil, and therefore it is necessary that they be dried before being subjected to the process of distillation.

The oil is of two distinct varieties, the one being sage green, and the other the colour of medium coloured sherry.

Mr. Hardouin informed me that the green oil is produced from young leaves, and the golden-brown from old leaves, but I am inclined to think that there is a little doubt about this, and that soil and shade have more to do with the colour of the oil than the age of the leaves.

Sometimes the one colour is in greater demand than the other, but the prices are the same for both. At present the price in Penang is about 50 cts. per ounce.

Whether the oil is adulterated or not I have been unable to find out, but the chances are largely in favour of it if it passes though the hands of the Chinese merchants. I obtained two samples of the oil direct from the distiller, and find they are limpid and quite fluid at ordinary temperatures, but at 4° F. they become rather thicker, but remain bright and clear.

The golden-brown oil has a specific gravity of ·9580 at 85° F., and the green oil a specific gravity of ·9578 at the same temperature.

The spectrum exhibited by the golden-brown oil is not crossed by any absorption bands, and is, therefore, not of much use in detecting admixture of foreign oils. The red, yellow, and green light, as far as the *b* line, is transmitted with full intensity; but the blue-green from *b* to F is much absorbed, and beyond the latter line all is complete darkness. The limits of this spectrum in wave lengths are 7140 to 4165 the oil being contained in a tube ·6 inch in diameter, both daylight and lamplight being used with the same results.

The green oil gives a spectrum of full intensity from the *c* line to midway between the *b* and F. lines, from which point it shades off gradually and disappears a little before the *h* line is reached. At the red end it extends beyond the *c* line, but with reduced intensity as far as to between the A and *a* lines. In wave lengths the limits of this spectrum are 7390 to 4130 in daylight. Lamplight gives a greater extension towards the red end, but much less in the violet.

I have seen oil that has been kept for 10 years in a bottle with a loose stopper, which had become of a dark-brown colour and of a syrupy consistency, but it seems probable that it would not undergo this change if kept in a tight stoppered or corked bottle. The scent of this old oil, however, was little inferior to fresh, though not quite so powerful. This bears out the statement in Ure's *Dictionary of Arts*, that "the "essential oil of patchouli is one of the least volatile of any known, "hence it is one of the most persistent of perfumes from plants."

In the same work it is stated that if the plant be distilled, after it has been gathered several years, more than half the product will assume a crystallisable form far less fragrant than the newer fluid essential oil, and would probably be quite odourless if repeatedly crystallised from alcohol. The crystals of patchouli are rhombic with pyramidal summits; chemically they resemble camphor in composition. When the fluid essential oil of patchouli is submitted to fractional distillation, there comes at the highest temperature a peculiar blue body, termed by

Piesse *Azulene*, "resembling the blue in the essential oil of wild "camomile; it requires, however, further examination."

"Ill effects, such as loss of appetite and sleep, nervous attacks, &c., "have been ascribed to the excessive employment of patchouli as a "perfume." (*Lindley's Treasury of Botany.*) But as one of its great uses is to mix with the stuffing of beds and pillows, under the idea that it is inimical to vermin, this can scarcely be the case. This same property of keeping-off insects caused it to be used to pack with Indian shawls and so led to its introduction into Europe.

In connexion with this it should be mentioned that I have distilled a quantity of the *Ruku* leaves (one of the plants used to mix with patchouli), and have obtained a very dark green viscous oil, smelling strongly of the plant.

The amount of oil is not great, and it is unlikely to have any value of its own, for the scent of it is not altogether pleasant.

MARKET.

Mr. N. Cantley, Superintendent of the Botanical Gardens, Singapore, in a paper entitled, "Notes on Economic Plants" in the *Journal* of the Straits Branch of the Royal Asiatic Society, says, "Plants of patchouli "have been in demand for experimental planting, and a good number "have been supplied. Picked leaves are now selling at $17 per pikul. "The plants grow freely with but little care, and should figure among "colonial products." This statement, although correct as far as it goes, gives a mistaken idea of the circumstances of the case. The production now is quite equal to the demand, which seems to be very limited, consequently the market is soon glutted, particularly with the oil. A Penang merchant writes me that "the demand is very slack at present "owing to an over-production of the leaf, stimulated by the high prices "paid about a year and a half ago. The article (the leaf) is used very "largely in Calcutta and Bombay, principally in the latter place." The same slackness is felt in the sale of the oil, the market for which, by-the-bye, is London. Another merchant informed me that the last lot of oil he had shipped to England had not found buyers at prices which would pay him to sell.

Unless therefore the use of the leaves and oil could be very materially increased, there seems to be no prospect of profitably cultivating it on a large scale.

CII.—P'U-ÊRH TEA.

In the *Kew Bulletin* for last month (1889, p. 118) an account was given of P'u-êrh tea which appears in commerce from the province of Yün-nan in the south-west of China. At the time this account was written Kew had not received from the Foreign Office the very important *Report of a Journey in South-Western China* by Mr. F. S. A. Bourne, Her Majesty's Consular Agent at Ch'ung Kiang.—China, No. 1 (1888), presented to Parliament last June. Attention to this report was drawn in the *Daily News* by a writer who had evidently made himself thoroughly acquainted with the subject. The information supplied by Mr. Bourne respecting P'u-êrh tea confirms in every respect the account already given in the *Kew Bulletin*, but he was able to gather locally numerous interesting facts respecting the manufacture and selection of the tea which are given in the following extracts:—

The tea hills are situated six to ten days south-west of Ssŭ-mao and about the same distance north-west of the Me khong on both sides of a left bank affluent of that river. It is six days' journey from Ssŭ-mao to I-bang, the chief of the tea-hills. The road was said to cross two steep hills during the first day and two steep hills during the second day; the third day the road is downhill for the most part to Mêng-wang T‘u-ssŭ which is very malarious; on the fourth day there is a further descent to the Man-nao river; on the fifth day the road is up and down hill for the whole distance; and on the sixth day there is a steady ascent to I-bang. From I-bang to Yu-lê is three days' journey, and to I-wu two days'. From Man-nai to Chêng-tung is two days', and from Cheng-tung to Mo-hei three days' journey. A day's journey may be taken as 18 to 22 miles. Yu-lê formerly belonged to the I-bang district, but became the property of a Yao chief who gave it with his daughter when she married a former Hsüan-wei Ssŭ whose private property the hill now is.

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On the 2nd January 1885 the magistrate was kind enough to take me to see some tea trees at a place called Lu-ying, three-quarters of a mile to the north-west of the city, where he had a big arbour erected of bamboos covered with fir branches to sit and talk in. There were only five trees, of which one stood about 12 feet high, consisting of seven stems, the biggest of about 4 inches diameter; this tree was said to be very old. The magistrate told me that these trees were the remnant of an extensive plantation that was cut down and burnt during the Mahommedan rebellion, and that they were of exactly the same species as that from which P‘u-êrh tea is made. Whether this is so, or whether these are merely wild tea trees, which are found here and there all over Southern China, it is impossible to say. According to popular tradition, tea was introduced into this part by the great K‘ung-ming when he conquered the south.

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At all events, it does not seem likely that shrubs on the Ssŭ-mao plain ever gave good tea, or the leaf would not be brought here from 6 to 14 days' journey south, over bad roads; and, further, it is only within the last eight or nine years that the leaf has been brought out and made up at Ssŭ-mao at all.

It would be necessary to visit the tea-hills to give a satisfactory account of the trade; meantime the following notes, the result of many inquiries, may be useful. Neglecting the official account,* which does not square with present facts, we must begin with the distinction between tea grown on the hills, I-bang, I-wu, Mansa, and the neighbouring heights, called "yen ch‘a" (strong tea), and that which grows on the lower slopes and in the valley of the Me-khong and its tributaries, called "san ch‘a" or "yeh ch‘a" (wild tea).

The finest tea, made of the young spring leaves from shrubs on the hills, is called "ya ch‘a" or "mao-chien." This is only made at the hills, and I could not obtain a specimen. Some of this good leaf was said to go to Yünnan Fu, and there to be made up into balls as big as a man's head, for the Court at Peking. The next quality is called "pai chien" or "hsi ch'a," and is sent in small quantities to many parts of the empire, where very high prices are paid for it.

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* Notes from the "Topography:" the six tea-hills are Yu-lê, Kê-têng, I-bang, Mang-chih, Man-chuan, and Mansa (another extract substitutes Chia-pu, Hsi-k‘ung, and I-wu for Yu-lê, Mang-chih, and Mansa). The hills occupy an area with a circuit of 800 li. There is a tree called the tea-king, singular as being much bigger than any other tree at the hills. It was planted by K‘ung-ming; even to the present day the aborigines worship it. The flavour of the tea varies with varying soils; it is best grown on red earth or amongst stones of different kinds; it then helps digestion, dissipates fever, and acts as as an antidote.

The tea made up at Ssŭ-mao is for the most part of the second description, *i.e.*, "san ch'a." During the season, which extends from March to September, the leaf from the lower levels is picked, rolled, dried, and sent to Ssŭ-mao, packed on the backs of oxen; there it is sorted out into heaps according to quality. The manufacture of the leaf into the familiar cake of P'u-êrh tea, well known all over West China, goes on all the year round. I saw the process, which is very simple, in the go-down of a firm trading under the name of "New Spring Thunder." A large round iron boiler, of the well known Chinese pattern, is covered by a wooden barrel, held in position by a heavy stone, so that a vigorous jet of steam issues from a single vent at the top. Nine Chinese ounces of tea are weighed out and sprinkled into a copper vessel perforated below, which is then placed over the vent so that the tea is permeated by steam. After about a minute the vessel is removed and the tea poured into a cotton bag, the ends of which are wound round and squeezed into a lump in the middle of the cake. The bag is then placed beneath a heavy stone, on which a man stands, and pressed into a quoit-like shape, the ends of the bag making the indentation in the centre. The cake is then placed in a rack to cool. When cold the bag is removed, and the cake is in the condition of the P'u-êrh tea of commerce. The same process is said to be followed at the hills.

In the case of the particular tea of which I watched the manufacture, the finer sort of Ssŭ-mao tea, that goes to Ssŭ-ch'uan, four descriptions of leaf were used—the 9 oz., consisting of ½ oz. fine young leaves and 1½ oz., 3 ozs., and 4 ozs. of three other qualities coarse in proportion to their weight; and the whole art of the process appeared to consist in a judicious arrangement, by which the white delicate leaves were made to take up a conspicuous position on the outside of the cake, while the coarsest sort was carefully billeted in the centre. No. 1 was "pai-chien;" Nos. 2 and 3 were from the smaller hills in the neighbourhood of I-bang and I-wu, called "so-pien" (what is at the side); and No. 4 came from the plain of Mɛ-khong, and was probably wild tea, from which the coarsest leaves had been sorted.

It will surprise no one acquainted with China that the rule that the best tea is to be made up at the hills is very badly observed. What rule is not? In fact, the merchant Thunder, managing partner of the New Spring Thunder House, told me that No. 1 was from I-wu. The truth is that the making up in a cake so favours blending that no tea seems to come from one place or to be of one quality. The only way to get an idea of the trade is to make very broad distinctions. Taken in this way P'u-êrh tea may be divided into five classes, viz.:—

1. The finest tea, called "mao-chien," "ya ch'a," &c. This is made in small quantities at the hills, and I could get neither reliable particulars as to price nor specimens.

2. Tea of good quality called "hsi ch'a," &c., of which there is a large export to other provinces through Yünnan Fu, especially to Ssŭ-ch'uan. The tea of which I watched the manufacture, as described above, was an inferior tea of this class (specimen sent to India).

3. "Ping lao," this is "so-pien" tea, just as it is picked without being sorted. Sent to I-hsi or Western Yünnan (Ta-li Fu, Yung-ch'ang Fu, &c.) (specimen sent to India).

4. Inferior tea, made chiefly at Ssŭ-mao, and consumed in the province of Yünnan.

5. "Chin-t'uan," made in balls for the Ku-tsung and Thibetan market. This is made of the coarsest yellow leaves picked out from other varieties, with a shallow coating of "so-pien" on the ouside of the ball (specimen sent to India).

The four first descriptions are packed in a "t'ung," or packet, of seven cakes, which therefore weighs 63 ozs., or with the covering of bamboo bark 4 catties. Twelve such packets are placed in a bamboo case, which forms one side of a horse's load, the load being thus 96 catties. The seven balls of class No. 5 are packed in a roll, which is supposed to be of the same weight as a packet, but the Thibetans are regularly squeezed some ounces on each roll.

Prices at Ssŭ-mao, duty paid, are said to have averaged during 1885 as follows:—

No. 2, "hsi ch'a," 14 taels per 100 catties; No. 3, "ping-lao," 12 taels per 100 catties; No. 5, "chin-t'uan," 9 taels per 100 catties. Carriage from Ssŭ-mao to Yünnan Fu ranges between 3 taels and 3 t. 5 m. per 100 catties. Duty at Ssŭ-mao is 7 mace, and *li-kin* 1 tael to 1 t. 2 m. per 100 catties according to quality.

The estimates of the amount of tea turned out during the year varied from 12,000 to 24,000 [?] loads. There are two roads by which the tea comes, one from I-bang through Ssŭ-mao, and the other from I-wu through Mêng-nai to Mo-hei. There are *li-kin* stations both at Ssŭ-mao and Mêng-nai. The most reliable estimate was given me by the *li-kin* collector at Ssŭ-mao, who said that Ssŭ-mao sent 3,000 to 4,000 loads in the year, and the hills about 12,000, making in all a production of about 15,000 loads, about half of Nos. 2 and 4, and half of Nos. 3 and 5. Taking 12 taels as the average price per load, the gross value of the trade here during 1885 would have been about 180,000 taels, or 45,000*l*.

The supply was said to depend on the demand from Yün-nan Fu, which seems to be the *entrepôt* of the trade. The production had been much greater in 1884. The trade had suffered greatly from the rebellion, when the trees were cut down and burnt, and the people who used to buy the tea were killed. The demand from Ssŭ-ch'uan had increased and had partly made up, but prices had recently been very bad in consequence of the high price of food in that province, which left the people little to spend on good tea.

CIII.—AGRICULTURAL INDUSTRIES AT THE GAMBIA.

The British Settlement on the Gambia according to the *Colonial Office List* consists of the Island of St. Mary, British Combo, Albreda, the Ceded Mile, and McCarthy's Island, situated between the falls of Barraconda and Bathurst. This island forms the line of demarcation between those portions of the river known as the *upper* and *lower* river, the whole of the latter being British waters. The total area of the settlement is about 69 square miles. The principal productions of the settlement and of the adjoining districts are ground nuts, hides, beeswax, rice, cotton, maize, guinea corn, palm kernels, india-rubber, cola nuts, and native "pagns" or country cloths. With the exception of the weaving of cotton into native cloths called pagns, the manufacture of vegetable oils, boat-building, and some brick-making, there are no manufacturing industries in the country. The ground nut is the staple product of the settlement. This is exported to the South of Europe for the extraction of oil. Owing, however, to the competition of mineral oils, the demand for ground nut oil has declined, and at the present time the sole industry in the Gambia is threatened with extinction. Under these circumstances steps are sought to be taken to promote new industries and revive interest in others which flourished before ground nuts claimed chief attention.

The present Administrator of the Gambia, Mr. Gilbert T. Carter, has taken a deep personal interest in the subject, and at the request of the Secretary of State for the Colonies, suggestions have been offered from Kew with the view of supporting Mr. Carter's efforts. The exact circumstances are very fully dealt with in the following papers:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 2nd January 1889.

I AM directed by the Secretary of State for the Colonies to transmit for your information copies of correspondence with the Governor of the Gambia relating to expenditure on agricultural experiments.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director, Royal Gardens, Kew.

ACTING ADMINISTRATOR CARTER to LORD KNUTSFORD.

Government House, Bathurst,
2nd October 1888.

MY LORD,

I HAVE the honour to report that I have been endeavouring to turn to profitable use some of the large available space in the Government House grounds at Bathurst. Hitherto it may be said that no attempt has been made to utilise or even render attractive the so-called garden attached to the house; though it must be admitted that unless the Administrator was prepared to spend his own time and money over this desirable improvement, it would be impossible to alter to any appreciable extent the unsatisfactory condition of things which appears to have been recognised as inevitable by successive Administrators of the Government.

2. There are 3¾ acres of ground in connexion with the house, and the rule has been to provide in the annual estimates for *two* labourers who were supposed to be equal to the task of keeping this space in order; these two men for many years have been army pensioners with the proverbial faculty for continuing their existence which is characteristic of annuitants. One, however, was dismissed some time ago for misconduct, and the other still remains and does the best his years will permit. I have been unable to discover this man's age, but have ascertained that he received his discharge in 1863 as being "worn out by long service." The other pensioner has of course been replaced by a younger man.

3. I have been determined, however, to make an effort to improve matters, and accordingly I devoted my horse allowance to the employment of four men who could act as hammock-men as well as labourers, and with the assistance of convict labour commenced to clear a large space which had always been a wilderness of rank grass, and a refuge for snakes and other noxious reptiles. A small alligator was found there on one occasion, and as the space in question was separated from the house only by about 10 yards, unpleasant reflections were apt to obtrude themselves upon one's imagination, more especially during the dyspeptic periods, which are not uncommon during the rainy season in Bathurst.

4. As I found even the additional four men insufficient, and moreover was out of pocket by the arrangement, as the men could not be got for less than 1*l.* per month, and expect rations when they are employed away from Bathurst, I engaged two more men, and drew the available horse allowance of the superintendent of police whose duties the Administrator is at present performing, and with these six men, in addition to a small gang of convicts, I have succeeded in reducing the grounds to something like order, but vegetation grows so rapidly in this country that the men have to be constantly employed even to keep the place clear.

5. I hope in time to render this space both ornamental and productive. I have planted a number of cocoa-nuts, bananas, and plantains, and intend to experiment upon other economic trees and plants. I find that amongst some plants sent out to Administrator Moloney from Kew there is a valuable rubber-producing tree, the Ceara Rubber (*Manihot Glaziovii*).

6. As this tree evidently thrives vigorously in the soil of the Gambia, its introduction here cannot fail to be of immense advantage to the settlement. I have transplanted several young trees in the space now made available for experiments of this nature, and have no doubt, with the personal care which I shall be able to devote to them, that they will be successfully established.

7. Your Lordship cannot fail to realise the importance of the extension of economic botany in a place like this, which is practically dependent upon one staple, and I feel sure that I may count upon generous assistance from the Colonial Office in my endeavours to introduce new or extended industrial sources.

8. One grave drawback at Government House is the want of good water in the dry season; there are four wells, but the water in all of them is brackish. At the Military Hospital a short distance off there is good water, and much time and labour is wasted by the necessity of conveying water for irrigating purposes from one place to the other. It is my intention to go on digging in various places at Government House until I find good water, for it is a curious circumstance in this place that a brackish well and one with sweet water may be found within a few yards of each other.

9. It is my intention to ask your Lordship to allow me to place the sum of 300*l.* in the Estimates for 1889 to enable me to carry on my experiments. This sum to be devoted to labour, the digging of wells, and if necessary procuring large tanks for the storage of rain-water. I propose also if practicable to get a gardener from Madeira who will be able to superintend the work under my directions and see that the men do not idle. During the present rainy season I have had to do a great deal myself, with the result that for some weeks I was far from well, though fortunately not incapacitated from work—the season, however, has been an unhealthy one, and there has been a good deal of fever about, from which the Natives have not been exempt.

I have, &c.
(Signed) G. T. CARTER,
Acting Administrator.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

LORD KNUTSFORD to ACTING ADMINISTRATOR CARTER.

SIR, Downing Street, November 15, 1888.

I HAVE the honour to acknowledge the receipt of your despatch, separate, of 2nd ultimo, reporting what you had done with a view to turning to profitable use the grounds of the Government House at

Bathurst, and asking permission to place on the Estimates for 1889 a sum of 300*l.* to enable you to continue your experiments.

Under the circumstances I will not withhold my authority for the insertion of the amount in question in the Estimates, but it must be distinctly understood that its sanction will depend upon your being able clearly to show that the income of the Colony will properly bear the charge; and if, during the year, the revenue shows any signs of diminution the expenditure on this service must be at once stopped.

I have to convey to you my sanction of what you have already done in the matter, and of your employment for the purpose of the available horse allowance of the Superintendent of Police.

I have, &c.
(Signed) KNUTSFORD.

The Acting Administrator of the Gambia.

ADMINISTRATOR CARTER to LORD KNUTSFORD.

Government House, Bathurst,
December 3, 1888.

MY LORD,

I HAVE the honour to acknowledge the receipt of your Lordship's despatch "Separate," of the 15th ultimo, conveying assent to my proposal to place the sum of 300*l.* in the Estimates for 1889 in order that agricultural experiments might be made in the grounds of Government House, which it is hoped may ultimately prove beneficial to the settlement, provided I am able to show that the income for the coming year will properly bear the charge.

2. I beg to thank your Lordship for this concession, and shall hope to be in a position to include the sum specified, which I am sure will bear the approbation of the Legislative Council.

3. I have already demonstrated that the Ceara Rubber tree thrives remarkably well, and grows with great rapidity, and I hope during the next rains to be in a position to distribute some young trees in Combo, and in the Ceded Mile.

4. Your Lordship may be sure that in the event of the revenue showing any signs of diminution I shall at once cease to draw upon the vote, but I have every expectation that there will be a marked improvement in the trade of the Gambia during next year, which I trust may be sustained in future ones.

I have, &c.
(Signed) G. T. CARTER,
Administrator.

The Right Hon. the Secretary of State
for the Colonies, &c. &c. &c.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew, January 17th, 1889.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of January 2, transmitting copies of correspondence with the Administrator of the Gambia on agricultural experiments.

2. It appears to me that Mr. Carter's efforts to introduce the cultivation of new staples into the Gambia are extremely creditable to him, and deserve every encouragement.

3. I find, from the records here, that as far back as 1863, Governor D'Arcy pointed out to the Duke of Newcastle "how very varied and numerous" were the articles exported from Senegal as compared with

those from the Gambia. Sir William Hooker appears at that time to have urged the introduction of "economical and commercial plants."

4. The staple product of the settlement, however, still remains the ground nut, and I understand that the financial equilibrium of the Gambia is practically dependent on the success of the crop. This appears to me a very precarious position. Till, however, Captain Moloney became Administrator in 1884, I cannot discover that any determined attempt had been made to introduce any other plant which would add to the resources of the settlement.

5. A large collection of ornamental and economic plants were sent out from Kew in 1884 to Administrator Moloney, and amongst these the Ceara rubber tree, *Manihott Glaziovii*, appears to have become established. If the extraction of rubber from this tree were found practicable by the natives, and its cultivation were extended, a valuable new industry would spring up.

6. In 1886 a sample of Yoruba indigo was forwarded to Kew for report by the Colonial Office on the part of the Honourable J. D. Richards, Member of the Legislative Council of the Gambia. This is a kind of indigo peculiar to the West Coast of Africa and inferior in value to ordinary commercial indigo. It does not appear at present to be known in commerce. But it is quite possible that if the mode of preparation could be improved it might find a market and so give rise to an established industry. (See *Kew Bulletin* 1888, pp. 268, 269).

7. In the same year, at the request of Administrator Carter, a case of Vanilla plants was procured and despatched to the Gambia. From a subsequent report it appears that they reached their destination in excellent condition and promise to do well.

8. It is quite evident that the success which has been obtained in these two cases might be indefinitely extended. Everything however depends on having men on the spot, like Administrators Moloney and Carter, who will take a personal interest in the experiments. The ground about Government House which Administrator Carter has cleared appears excellently suited for the purpose if only a supply of water which is not brackish could be secured. Certainly it is most praiseworthy to have declined to follow the example of his predecessors in regarding "as inevitable" the occupation of this ground by rank grass, snakes, and alligators.

9. As you are aware a botanical station has been established at Lagos and is now in working order. This has been stocked with a large variety of seeds from Kew or sent through this establishment from other tropical colonies. Administrator Carter might perhaps draw on the resources of the Lagos Botanical Station both for plants and seeds as well as for information as to the practical results derived from the experimental cultivation of various introduced plants. In the meantime it appears to me that an attempt might be made to establish at the Gambia the cultivation of both Liberian coffee and of the cocoanut. Neither of these important plants are, as far as I am aware, cultivated in the Settlement.

10. The despatch of the Secretary of State does not perhaps view the Administrator's attempt in a very sanguine spirit. I do not for my part see why some measure of success in work of this kind should be despaired of at the Gambia. The history of this settlement is no doubt depressing. But as far as I can ascertain no one before Administrators Carter and Moloney has ever attempted to face the problem, and it appears to me that work of this kind deserves every support. The achievement of results no doubt demands patience. But the example of

Sir John Kirk at Zanzibar shows that persistent effort in this direction is not without its reward even in a comparatively brief space of time.

I am, &c.
(Signed) W. T. THISELTON DYER.
Sir R. W. Herbert, K.C.B.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 26th January 1889.

I AM directed by the Secretary of State for the Colonies to thank you for your letter of the 17th instant on the subject of the agricultural experiments which are being made by the Administrator of the Gambia, and to transmit to you a copy of the despatch with which our letter has been sent to Mr. Carter.

I am, &c.
(Signed) ROBERT G. W. HERBERT.
The Director, Royal Gardens, Kew.

LORD KNUTSFORD to ADMINISTRATOR CARTER.

SIR, Downing Street, 25th January 1889.

WITH reference to your despatch, separate, of 3rd ultimo, I have the honour to transmit to you a copy of a letter from the Director of the Royal Gardens at Kew on the subject of the agricultural experiments which you are making at the Gambia.

I would suggest that you should communicate with Governor Moloney with the view of obtaining plants, seeds, and information from the Lagos Botanical Station, as recommended by Mr. Thiselton Dyer.

I fully approve of your efforts to develop the resources of the settlement and introduce fresh articles for cultivation, and I shall look with interest to see the result of your experiments.

I have, &c.
Administrator Carter. (Signed) KNUTSFORD.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

Downing Street, April 6, 1889.

THE Under Secretary of State for the Colonies presents his compliments to the Director of the Royal Gardens, Kew, and begs to enclose for his information a copy of a despatch from the Governor of the Gambia on the subject of certain agricultural experiments.

[Enclosure.]

ADMINISTRATOR CARTER to LORD KNUTSFORD.

Government House, Bathurst,
MY LORD, March 1, 1889.

I HAVE the honour to acknowledge your Lordship's despatch No. 7. of the 25th January, enclosing a copy of a letter from the Director of Kew Gardens, having reference to the agricultural experiments which I am conducting in the grounds at Government House in the Colony.

2. I am very gratified to receive your Lordship's approval of my efforts in this direction and likewise the encouraging remarks of Mr. Thiselton Dyer, which I trust will stimulate others besides myself to give greater attention to this most important subject.

3. It has always seemed to me that the question of agriculture is the one of all others to which an Administrator of the Gambia should principally devote himself, if the material prospects of the country are to be advanced beyond the narrow line which has hitherto been deemed sufficient by those responsible for the government of the old settlement. Successive Administrators have deplored the restriction to one staple, but it has not yet been found possible to supplant the solitary product upon which the Gambia has been practically dependent for so long, or to add to the list of exports, which to any appreciable extent would influence the revenue of the Colony.

4. The severe lesson which we have lately received ought at any rate to impress upon us the gravity of the situation, and it was with a full consciousness of the necessity for a move to be made in the direction indicated, that I suggested the addition of a sum of 300*l*. to the estimates for 1889 in order that a start might be made to show whether the future of the Colony is or is not to be bound up in the inevitable ground-nut.

5. It is certain that nothing can be done without the initiative of the Government. At the present moment there is no mercantile establishment in the Colony in a position to sink capital in such a venture, and under any circumstances to secure a measure of financial success it would be necessary to undertake any planting operations, which might be decided upon, at some distance from Bathurst, where the protective capacity of the Government would be of a very limited character. There are, I admit, many serious difficulties in the way of developing the agricultural resources of the Gambia, but it is clear that nothing can be gained by the absence of any effort to overcome them. The great and principal drawback is the want of good water. I know of no well in Bathurst which gives a supply which is not more or less brackish, thus very seriously militating against the growth of many plants on the island itself. On the mainland of Barra and Combo the same difficulty exists, but there are certain spots where a permanent supply of good fresh water is to be obtained, and if the Colony were in a position to establish a Botanical Garden in one of those localities, and to maintain it on a proper scale, I am quite sure that much good would result. It would, however, be necessary to secure the services of a thoroughly competent manager, who should be a trained botanist, with a proper staff of labourers. There can be no doubt that any money spent in this direction would be well laid out. Another difficulty arises from the comparatively small rainfall of this district, whereas only 500 miles to the southward there is a rainfall of sometimes over 200 inches, in the Gambia it rarely exceeds 50 inches, and there is practically eight months drought. As may be readily understood, such climatic conditions are very trying to many vegetable products otherwise suited to tropical life. Nevertheless, there are many valuable plants which thrive even under such circumstances, and the problem is to find and utilise them. I am very sanguine that one of these plants has been found in the Ceara rubber tree (*Manihot Glaziovii*). All the seedlings which I have raised are growing vigorously, and I have carefully collected all the seeds procurable from last year's bearing, and intend to distribute them in favourable localities for planting during the next rainy season; as the plants grow equally readily from slips, I shall also raise trees where practicable by these means.

6. The whole of the Government House grounds have now been cleared, and many of the cocoa-nuts which I planted in August last have commenced to shoot. I am economising the 300*l*. as much as

possible during the dry season, as there is not much to be done except watering and keeping down the weeds, which spring up even with the present absence of moisture, but a good staff of men will have to be kept on during the rainy season to prevent the grounds from falling back into their original condition. I shall endeavour to secure the services of a practical gardener from Madeira or the Canary Islands from July to the end of the year, on the most reasonable terms possible.

7. In regard to the Vanilla plants, they did very well so long as I was able to give them my personal attention, but subsequently they all died off. I do not think however that the Gambia is suitable for this plant. So far as I know they thrive best in countries where there is a more copious rainfall and the soil contains a larger proportion of nutritive properties than is the case here. I fear also that the Liberian coffee would fail from the same cause, though there may be localities in Combo where the shrub might be grown to a limited extent. The principal ingredient in nearly all the soils I have examined, even at some miles in the interior, is sand, and as the ground is never manured in a practical and efficient manner, its productive qualities are naturally much restricted.

8. Since my arrival in Bathurst six and a half years ago I have endeavoured, both by example and precept, to demonstrate to the native mind what can be done by intelligent manipulation of a sterile and unpromising soil. I started a garden in the Military Hospital compound which produced most of the English salads and vegetables in great perfection, and which I am glad to say is still in full vigour. It was a part of my plan to show that an English gentleman was not too proud or too indolent to work with his hands, for in the early morning and evening I prepared most of the beds myself, and trained a man in the proper method of working the system to advantage. Since then most of the Europeans have started gardens, but I regret to say that the native class whose interests I was anxious to advance have not yet learnt the lesson I endeavoured to inculcate. Even now it is not possible to buy a cabbage or lettuce in the market, although almost every householder in Bathurst might cultivate a small plot of ground if he chose to do so. In spite of the brackish water, I have grown strawberries quite equal to the ordinary growths in England, and although the natural soil is the worst imaginable for the successful cultivation of roses, yet with judicious management I possess many vigorous plants which give me a daily supply of their exquisite blossoms. I mention these personal matters not in any spirit of self-glorification, but merely to show that in spite of natural difficulties they may be overcome with patience and effort. It is possible that I may not be here to witness the fruits of my labours, but I trust some future Administrator of the Gambia may be able to lock back with satisfaction upon the small fund which was set aside for agricultural experiments in the year 1889.

I have, &c.
(Signed) G. T. CARTER,
Administrator.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR,

Royal Gardens, Kew, May 15, 1889.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 6th instant, forwarding a copy of a despatch from the Administrator of the Gambia on the subject of certain agricultural experiments undertaken by him in that settlement.

2. It is evident from this despatch, as indeed from previous papers forwarded from Mr. Carter, that he is fully prepared to grapple with the difficulties incidental to an attempt to give new life and direction to the vegetable products of the Gambia. He appears to be well acquainted with the drawbacks as affecting vegetable life inseparable from a small rainfall and an unpromising soil, and there are therefore reasonable hopes that his efforts will be directed so as to produce results of a permanent and satisfactory character.

3. As preliminary industries Mr. Carter is disposed to regard the cultivation of cocoa-nuts and ceara rubber trees as well suited to the circumstances of the Gambia. Indeed some measure of success has already been attained with these. As regards cocoa-nuts it would be well to follow the systematic efforts made under similar circumstances in the Colony of Lagos by Governor Moloney and establish large nurseries of seed cocoa-nuts from whence plants could be supplied at a cheap rate or free to all persons willing to undertake their cultivation. The exact localities for establishing nurseries can be decided only on the spot. It is important, however, that the nurseries be easily accessible to the people, and if possible under their observation. From what can be gathered on this side Cape St. Mary and similar localities deserve to be specially considered in connexion with the planting of cocoa-nut palms.

4. In a despatch from Governor Moloney to the Colonial Office, dated 12th November 1888, it is stated, "At the end of September the cocoa-" nut seed planting of the Government reached 31,483. It is intended " to establish permanently in the Eastern and Western Districts, at the " beginning of the next rainy season, plantations to the extent of 30,000, " the fruit of which in time should be worth 6,000*l.* per annum to the " Government; further, to continue in the future the nursery work to " keep a supply of seedlings on hand to replace failures, and for distri-" bution among the people in exchange for seed nuts, or by purchas " at the low rate of one penny each . . . . The Govern-" ment has recently received an order for 1,000 seedlings for a cocoa-nut " plantation contemplated at the south east end of the Island of " Lagos."

5. In the Fifth Report on the Botanical Station at Lagos recently issued it is further mentioned that "1,000 cocoa-nut seedlings have " been recently sold during the quarter from the Leckie nurseries," and " 5,000 cocoa-nut seedlings are to be supplied in the Western District " at the beginning of the next rainy season."

6. To obtain results that will at all affect the welfare of the settlement it is necessary at first to take up two or three of the most suitable and promising cultures and promote them by such energetic and systematic efforts as are above described. A cocoa-nut industry would ameliorate local conditions, as well as give rise eventually to an export trade. In addition to fresh nuts, for which there is a steady demand both in Europe and in the United States, there would eventually arise a demand for oil and copra as also for coir fibre, similar to what was lately sent to this country from Lagos. The best or "bristle" fibre sells at 30*l.* per ton, while "mat" fibre sells at about 10*l.* per ton.

7. If the cocoa-nut palm thrives at all at the Gambia and yields only moderate crops it is evident that no plant can be more suitable for general permanent cultivation. Its natural home is on sandy sea-shores exposed to the full influence of the sea, and if there is water in the subsoil it can bear certain periods of drought with impunity.

8. It is gratifying to find that the Ceara rubber plants (*Manihot Glaziovii*) sent from Kew in 1884 have found a congenial home at the Gambia. The climate of their natural habitat is described as "very "arid for a considerable part of the year." Hence they would appear to be well suited to the circumstances described by Mr. Carter. It is well, however, to remember that the Ceara rubber trees will not repay such regular cultural attention as may be given to cocoa-nut palms. It would be prudent in the first instance to establish the trees as economically as possible by "dibbling" germinated seeds over a large extent of country and treat the plants on the principles of forestry rather than those of pure agriculture. The yield of rubber per tree is small, and hence it would require several thousands to afford anything like an appreciable quantity of rubber. If any difficulty is experienced in obtaining supplies of seed this establishment might possibly be able to arrange to procure them from Ceylon or India. Information respecting the tapping of the trees for rubber could also be furnished later.

9. It is evident, however, that to make an immediate impression upon the prosperity of the Gambia it is necessary to take up other cultures than cocoa-nuts and Ceara rubber. Amongst the plants yielding an immediate return it might be desirable to revive on a large scale the cultivation of maize or Indian corn. At one time it is understood this was grown at the Gambia, before the cultivation of the ground-nut became the dominant culture, and it was said to be exported to the Canary and Cape Verde Islands.

10. The suggestion is thrown out for what it is worth, but Mr. Carter might make inquiries through the Consuls and others whether there is still a market in these islands for Indian corn. If there is, it would require little effort on his part to persuade the people to take up the cultivation. Maize, it must be remembered, is an article in general demand in most temperate countries, and, depending upon the cost of production, it might be found advantageous to export it also to this country or the continent.

11. It has been found necessary in small and comparatively isolated communities like the Gambia to prepare the way and procure information respecting suitable markets before recommending the general cultivation of certain plants. The soil that suits the ground-nut is likely also to suit Indian corn, and the treatment of the plants is very similar. So that, if the prospects of suitable markets are encouraging, the Government might introduce good strains of seed from other countries, and distribute such seed in localities suitable for its culture.

12. Very good specimens of cotton have been received from West Africa, and from the character of native cotton goods prepared inland it is evident that much could be done to extend the cultivation of good varieties of the cotton plant. Where labour is cheap the cultivation of the cotton plant possesses numerous advantages, and especially where the industry is already more or less familiar to the people. Coffee is also grown to some extent inland, and this again might be encouraged by friendly intercourse with the chiefs and the adoption of a consistent policy of encouragement to all agricultural pursuits.

13. Mr. Carter might be glad to peruse the interesting correspondence which has recently taken place respecting the cultivation of fibre plants at the Bahamas. Some portion of this appears in the *Kew Bulletin* for the month of March last. The conditions of climate and soil at the Bahamas and the Gambia are very similar. A semi-rude culture of the character required by species of *Agave* and *Furcræa* may be found suitable to some parts of West Africa, and for the produce there is a steady and almost unlimited demand both here and in the United States.

14. It is not intended here to do more, however, than indicate a few industries which might be experimentally tried at the Gambia. It is well known that efforts of the kind now put forth by Mr. Carter are so entirely dependent on the individuality of the Administrator that it is almost inevitable that they should be of a spasmodic character. It is no wonder, therefore, that the ground gained at one time is more or less lost at another. It would appear, however, that at this settlement at the present time some serious, but not necessarily elaborate, attempt should be made to promote new industries on permanent lines. If a small grant were voted yearly, and it were decided as a regular function of the Government to promote native agricultural industries, the results that would eventually accrue would undoubtedly favourably affect the general prosperity of the settlement.

15. At present Mr. Carter deserves every encouragement in his work, and whether by his own personal efforts or by means of the agency of a botanic station, worked on the same lines as that established at Lagos under Governor Moloney, a start is made in the restoration of industrial prosperity at the Gambia, Mr. Thiselton Dyer will be happy, as far as Kew is concerned, to extend his warmest sympathy and support to all such efforts.

I am, &c.
(Signed) D. Morris.

Sir Robert G. W. Herbert, K.C.B.

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ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 31.] JULY. [1889.

GUIDE TO THE BOTANICAL LITERATURE OF THE BRITISH EMPIRE.

The primary object of this compilation is to supply useful information on the literature of the systematic, economic, and geographical botany of the Possessions, Dependencies, and Protectorates of the British Empire. Kew is often called upon to answer questions, on the shortest notice, concerning the vegetation of some remote part of the world, and the best books to consult on the subject. Such questions are not always easily answered, and they frequently entail a considerable expenditure of time; hence the idea of preparing a concise guide. A complete bibliography was not wanted, for it would only perplex most persons in search of the latest or best exposition of the botany of any given part of the Empire. As in most cases where a selection has to be made, it is probable that some books and memoirs have been omitted that possess claims and merits equal to some of those included. This may be due either to inadvertence, or, what is more probable in the majority of instances, to the necessity for limiting the selection.

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1889.
Price Twopence.

Bentham and Hooker's "Genera Plantarum" and the Indian and various Colonial "Floras" have influenced the selection of elementary works, yet several others are equally as good, and might answer the purpose just as well.

Relatively more space has been devoted to remote islands and little known regions, because the published accounts of their vegetation are often in serials only met with in large libraries.

Persons wishing for further information have only to consult the works cited, where they will usually find references to all the books worth knowing. Taking British India as an example, it would have been of little practical utility to give the titles and descriptions of many of the rare and costly illustrated books. With few exceptions, the reports of the officers of the Indian and Colonial Forest Departments have not been included, though they often contain valuable matter, and should, as well as the consular reports, be searched by persons in quest of information on the vegetable productions of a country.

The Handbooks of the various Colonies prepared for the Indian and Colonial Exhibition in London in 1886 mostly contain useful information on the vegetable products.

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1. ELEMENTARY, INTRODUCTORY, AND OTHER PUBLICATIONS OF A GENERAL CHARACTER.

Hooker, W. J., and **J. D.** Icones Plantarum, vols. i.–xix., 1837–1854; resumed in 1867 and still continued. 8vo, tt. 1900.

Bentham, G. Outlines of Elementary Botany. London, 1861. 8vo. pp. 40. This is prefixed to all the Colonial Floras.

Lyell, K. M. (Mrs.). A Geographical Handbook of all the known Ferns. London, 1870. 8vo. pp. 225.

Bentham, G., and **Hooker, J. D.** Genera Plantarum. London, 1862–1883. Three vols. 8vo.

Baker, J. G. On the Geographical Distribution of Ferns: Transactions of the Linnæan Society, xxvi., 1868, pp. 305–352.

> A full tabulation and discussion of the distribution of the species known up to date.

Grisebach, A. H. R. Vegetation der Erde. Leipzig, 1872. Two vols. 8vo. (The second edition (1884) is practically no more than a reprint.)

Hooker, W. J., and **Baker, J. G.** Synopsis Filicum. 2nd edition, 1874. pp. 559, tt. 9.

Tchihatchef, P. de. La Végétation du Globe . . . par A. H. R. Grisebach, ouvrage traduit de l'Allemand, avec des annotations du traducteur. Paris, 1875–78. Two vols. 8vo.

Le Maout, E., and **Decaisne, J.** A General System of Botany, Descriptive and Analytical. Translated from the French by Mrs. Hooker, with additions by Dr. J. D. Hooker. London, 1873. 4to. pp. 1,066, with 5,500 figures by L. Steinheil and A. Riocreux.

Dyer, W. T. Thiselton. Lecture on Plant Distribution as a Field for Geographical Research: Proceedings of the Royal Geographical Society, xxii., No. 6, 1878. Also reprint, 8vo. pp. 36.

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Dyer, W. T. Thiselton. The Botanical Enterprise of the Empire. London, 1880. 8vo. pp. 36.
(A Paper read at the Royal Colonial Institute, May 11, 1880.)

Lindley, J., and **Moore, Thos.** The Treasury of Botany. 2 vols., small 8vo. 2nd edition, 1876.

Admiralty Manual of Scientific Enquiry: Botany, by Sir Joseph Hooker, pp. 418–432, edition 5, 1886.

Hemsley, W. B. Descriptive Catalogue of Marianne North's Paintings at Kew. London, 1886, fourth edition, small 8vo. pp. xxxii and 160.

Trendell, A. J. R. Her Majesty's Colonies. London, 1886. (Colonial and Indian Exhibition.) 8vo. pp. 508, with several maps.

Baker, J. G. The Fern Allies. London, 1887. 8vo.

Oliver, D. Lessons in Elementary Botany. London, 1887 edition.

Colonial Office List. Published annually. The edition for the year 1887 is the one used for the present publication.

Hemsley, W. B. Biologia Centrali-Americana (Salvin and Godman). Botany. Introduction. 1888. Vol. i., pp. i–lxi. World Distribution of Plants.

Kew Official Publications. Bulletin of Miscellaneous Information, monthly. Guides to the Museums of Economic Botany.

2. GREAT BRITAIN AND IRELAND.

It is not intended to enter into particulars of the vegetation of the United Kingdom, but it may be useful to persons visiting this country to give the titles of a few of the leading botanical books.

Watson, H. C. Cybele Britannica; or British Plants and their Geographical Relations. London, 1847–1859. Four vols. 8vo.

Syme, J. T. Boswell. English Botany. London, 1863–86, third edition. Twelve vols. large 8vo, with coloured plates of all the species.

Moore, D., and **More, A. G.** Contributions towards a Cybele Hibernica. Dublin, 1866. Small 8vo. pp. 399.

Moore, D., and **More, A. G.** On the Climate, Flora, and Crops of Ireland: Report of the Proceedings . . . . . . of the Botanical Congress, London, 1866. pp. 165–176.

Trimen, H. Botanical Bibliography of the British Counties: Journal of Botany, 1874, pp. 66–73, Cornwall to Surrey and Kent; pp. 108–112, Essex to Gloucester; pp. 155–168, Monmouth to Anglesea; pp. 178–183, Lincoln to Northumberland; pp. 233-238, Scotland.

Babington, C. C. Manual of British Botany, containing the Flowering Plants and Ferns, arranged according to the Natural Orders. London, 1881, eighth edition. Small 8vo. pp. 485.

Watson, H. C. Topographical Botany: Being local and personal Records towards shewing the Distribution of British Plants. London, 1883, second edition, edited by J. G. Baker and the Rev. W. W. Newbould.

Hooker, J. D. The Student's Flora of the British Islands. London, 1884, third edition. Small 8vo. pp. 563.

Fitch, W. H., and **Smith, W. G.** Illustrations of British Plants: a Series of Wood Engravings, with dissections. London, 1886. Second edition. 1,311 engravings.

Bentham, G. Handbook of the British Flora: a description of the Flowering Plants and Ferns. London, 1887. Fifth edition, by Sir Joseph Hooker. 8vo. pp. 607.

3. CHANNEL ISLANDS AND MEDITERRANEAN.

HELIGOLAND.—An island in the North Sea, in 7° 51′ E. long. and 54° 11′ N. lat., opposite and about twenty-five miles from the mouth of the Elbe. Area, inclusive of the adjacent island, named "Sandy," about three-quarters of a square mile. The main island is a red sandstone cliff about 170 feet high, and inaccessible except in one spot.

Hallier, Ernst. Die Vegetation auf Helgoland. Hamburg, 1861. 8vo. pp. 48, with four uncoloured plates.

The enumeration contains 150 species of phanerogams, about a third of which are introduced plants. *Hippophæ rhamnoides* and *Lycium barbarum* are the only woody species found in a wild state.

There is also a list of cultivated trees and shrubs, useful to persons planting near the sea.

JERSEY, GUERNSEY, ALDERNEY, and SARK.—The "Channel Islands" are situated between 49° and 50° N. lat., and between 2° and 3° E. long., with a maximum elevation of a little over 300 feet. Jersey, the largest, is about eleven miles long by four and a half in breadth, and Sark is three miles long, and a mile and a half in its greatest width. There are several smaller islets.

Babington, C. C. Primitiæ Floræ Sarnicæ. London, 1839. 8vo. pp. 132.

The total number of flowering plants and ferns recorded is 848; but this number has been slightly augmented by subsequent discoveries, recorded in various publications.

GIBRALTAR.—At the entrance to the Mediterranean, is about 36° N. lat. and 5° W. long. Area nearly two square miles, and greatest height 1,439 feet.

Kelaart, E. F. Flora Calpensis. Contributions to the Botany and Topography of Gibraltar. London, 1846. 8vo. pp. 220, with several views.

Gandoger, M. Plantes de Gibraltar: Bulletin de la Société Botanique de France, xxxiv. (1887), pp. 223–227 and 309–313.

Rouy, G. Plantes de Gibraltar et d'Algeciras: Bulletin de la Société de France, xxxiv., 1887, pp. 434–446.

A rich and varied flora, considering the smallness of the area, including a number of beautiful plants not known to occur elsewhere. Kelaart enumerates 456 species of indigenous flowering plants and ferns, and reproduces descriptions of new species published by Ed. Boissier in his "Voyage Botanique dans le Midi de l'Espagne pendant l'année 1837."

Gandoger's lists of plants, collected by Mr. L. Dasoi, add many new discoveries.

It may be desirable to mention that "Flora Calpensis" is the nom-de-plume of the author of "Reminiscences of Gibraltar," 1881.

MALTA.—An island in the Mediterranean, about 58 miles from Sicily, and about 180 from the nearest point of Africa. Valetta, the capital, is in 35° 54′ N. lat. and 14° 31′ E. long. Area about 95 square miles. Gozo is about 20 square miles in area, Comino about one, and Fifla, lying to the south-west, much smaller. The greatest elevation is about 1,200 feet, and there are neither streams nor lakes, hence the indigenous vegetation is poor and scanty.

Wickström, J. E. Plantæ Melitæ, etc.: Års-Berättelser om Botaniska Arbeten, 1843-4, Bihang, pp. 57–80.

Grech Delicata, J. C. Flora Melitensis, sistens Stirpes Phanerogamas. Malta, 1853. 8vo. pp. xvi and 49.

This work contains a history of the botanical literature of the island, and a list of 716 flowering plants, including colonists. Wickström's introduction is in French.

Delicata records *Statice reticulata*, *Centaurea crassifolia*, and *Parietaria populifolia* as endemic in Malta, but the first has since been found in Sicily.

CYPRUS.—This island is situated between 34° 33′ and 35° 41′ N. lat., and between 32° 15′ and 34° 35′ E. long., and has an area of 3,596 square miles, the mountains rising to a height of 6,000 feet. The climate is dry, and little of the original forest is left.

Unger, F., and Kotschy, Th. Die Insel Cypern. Vienna, 1865. 8vo. pp. 598, with map and views.

Hemsley, W. B. Gardeners' Chronicle, n. s. x. (1878), pp. 75, 106, and 183. A summary of the contents of the above-named work.

Wild, A. E. Report on the Forests of Cyprus, 1879.

Sintenis, Paul. Cypern and seine Flora: Œsterreichische Botanische Zeitschrift, 1881, 1882. A series of articles extending through these two volumes.

Gaudry, A. Recherches Scientifiques en Orient. Paris, 1885. Partie Agricole. Zones of Vegetation in Cyprus, pp. 186–202.

Unger and Kotschy's enumeration contains upwards of 1,000 species of flowering plants, including 51 trees, 66 shrubs, and 55 undershrubs.

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4. CONTINENTAL TROPICAL AFRICA.

West African Settlements and Protectorates.—Mostly small territories, alternating with French, Portuguese, and native possessions, from the Gambia river, in about 17° W. long., to the Niger river, in about 7° E. long.

The Gambia Settlement is in about 13° 24′ N. lat., and consists of the Island of St. Mary (Bathurst town), British Combo, the Ceded Mile, and MacCarthy's Island: the last is in the river, 187 miles above Bathurst.

Sierra Leone extends from 8° 30′ N. lat. to the Republic of Liberia, having a length of 180 miles and an area of 3,000 square miles. It includes Sherboro' Island, Isles de Los, and the Banana, Turtle, Leopard, Plantain, and other islets.

The Gold Coast or Ashantee Colony includes all the British territories between 5° W. long. and 1° 30′ E. long., being Newtown, Axim, Dixcove, Secondee, Elmina, Cape Coast Castle, Anamaboe, Accra, Addah, Quittah, Danes, and Afflowhoo. The length of coast line is about 350 miles, and the total area of the British Protectorate about 35,000 square miles.

Lagos Colony and Protectorate is situated between 2° and 6° E. long., in the Gulf of Guinea, and comprises the islands of Lagos and Iddo, Abouta, Mella, Badagry, Palma, and Leckie, and the Kingdoms of Appa, Katanu, Mahin, Ogbo, and Jakri, extending to the Benin river, where the British Protectorate of the Niger commences. Lagos Island has an area of three and three-quarter square miles, and the whole Colony and Protectorate includes about 1,071 square miles.

The Niger Protectorate extends over the entire basin of the Lower Niger river, including the Benin and Cross rivers, and eastward to the Rio del Rey, in about 9° E. long., and up the Niger and Binué rivers, to about 10° N. lat., including a belt of 30 miles on each bank of the rivers.

Palisot de Beauvois, A. M. F. J. Flore d'Oware et de Benin. Paris, 1804–1807. Two vols. folio, containing 120 coloured plates and descriptive letterpress.

Schumacher, C. F., and **Thonning.** Beskrivelse af Guineiske Planter, 1827. 4to. pp. 466. Extracted from the Konigl. Dansk Videnskabers Selskabs Skrifter.

Guillemin, A., Perrottet, S., et Richard, A. Floræ Senegambiæ Tentamen. Paris, 1830–33. 4to, with 72 coloured plates. Ranunculaceæ to Myrtaceæ.

Richard, A. Tentamen Floræ Abyssinicæ. Paris, 1847–51. Two vols. 8vo, and a folio volume of 102 plates.

Hooker, W. J. Flora Nigritana. London, 1849. 8vo.

Oliver, D. Flora of Tropical Africa. London, 1868–77. 8vo, 3 vols. Ranunculaceæ to Ebenaceæ.

Bowdich, T. E. Mission to Ashantee. London, 1819. 4to. ed. 2, 1873. Botany, by H. Tedlie, pp. 307–374 ; in ed. 2, pp. 282–286.

Moloney, A. Sketch of the Forestry of West Africa. London, 1887. 8vo. pp. 533.

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5. SOUTH AFRICA AND ISLANDS.

Under this general heading it is convenient to include the Colony of the Cape of Good Hope, Natal, Bechuanaland, Kaffraria, and the islands off the coast of Great Namaqualand.

CAPE COLONY.—Including the Transkei, this Colony has an area of 213,636 square miles, the most southerly point being in nearly 35° S. lat. From south to north the country, broadly speaking, consists of successively higher terraces, with very different climatic conditions. Real forests exist only in the south-east. Pondoland, Basutoland, and Bechuanaland are under the protection of the Cape or the Imperial Government.

NATAL.—About 800 miles from the Cape of Good Hope, but connected with the latter colony by the protected territories. Situated on the eastern side of South Africa, between 27° and 31° S. lat., and about 28° 50′ and 31° 35′ E. long., with an area of about 21,000 square miles. The Umzimkulu river and Drakensberg and other mountains form the south-western and western boundaries. The vegetation is sub-tropical in character, and very different from that on the western side of the continent in the same latitude.

Islands off the coast of Great Namaqualand, between 25° and 28° S. lat., attached to the Cape Government :—Hallam's Bird, Mercury, Ichaboe, Seal, Penguin, Halifax, Long, Possession, Albatross, Pomona, Plumpudding and Roastbeef. Walvisch Bay Station is also a Cape dependency. It is in this region that the very singular *Welwitschia mirabilis* is found.

Burchell, W. J. Travels in the Interior of Southern Africa. London, 1822–24. Two vols. 4to, illustrated.

Pappe, L. Floræ Capensis Medicæ. Cape Town, 1850. ed. 3, 1868. 8vo.

Pappe, L. Silva Capensis, or a Description of South African Forest-trees and Arborescent Shrubs used for technical economical purposes. Cape Town, 1854. 8vo. pp. 52.

Pappe, K. W. L., and Rawson, W. Synopsis Filicum Africæ Australis. Capetown, 1858. 8vo.

Harvey, W. H., and **Sonder, O. W.** Flora Capensis, being a systematic Description of the Plants of the Cape Colony, Caffraria, and Port Natal, 1859–1862. *Ranunculaceæ* to *Campanulaceæ.*

Harvey, W. H. Thesaurus Capensis, or Illustrations of the South African Flora. Dublin, 1859–1863. Two vols. 8vo, containing 200 plates and descriptive letterpress.

Baker, J. G. Descriptive Synopses of various orders of Petaloid Monocotyledons : Journal of the Linnæan Society, vols. xi., xiii., xv., xvi., xviii.

Harvey, W. H. The Genera of South African Plants. Cape Town, 1838. Second edition, 1868, edited by J. D. Hooker. 8vo. pp. 483.

MacKen, M. J., and **Gerard, W. J.** Synopsis Filicum Capensium. Pietermaritzburg, 1870. 8vo. pp. 28.

Buchanan, J. Revised list of the Ferns of Natal (reprinted from the " Natal Colonist "). Natal, 1875.

A. M. B. [Lady Barkly]. Revised list of the Ferns of South Africa (reprinted from the " Cape Monthly Magazine "). Cape Town, 1875.

Heywood, A. W. Cape Woods and Forests. Official Handbook, Indian and Colonial Exhibition, 1886. pp. 139–153.

Bolus, H. Sketch of the Flora of South Africa : Official Handbook of the Cape of Good Hope, Indian and Colonial Exhibition, 1886. There is also a reprint. 8vo, pp. 32.

Bolus, H. Contributions to South African Botany : Journal of the Linnean Society, vols. xviii., xix., xx., xxii., xxiv., and xxv.

Bolus, H. The Orchids of the Cape Peninsula : Transactions of the South African Philosophical Society, 1888, part 1 ; also issued separately. 8vo. pp. 200, with 36 plates, partly coloured.

Baker, J. G. Handbook of the Amaryllideæ. London, 1888. 8vo.

Wood, J. Medley. An Analytical Key to the Natural Orders and Genera of the Natal Indigenous Plants. Durban, 1888.

6. ASCENSION, ST. HELENA, TRISTAN DA CUNHA, FALKLANDS, AND SOUTH GEORGIA.

Ascension.—A volcanic, nearly circular island, in the South Atlantic, in lat. 7° 57′ S. and long. 14° 28′ W. It is thirty-four square miles in extent, rising to a height of 2,870 feet, and very barren, in consequence of the great scarcity of water. There are neither native trees nor shrubs, and very few herbaceous plants, though two, *Hedyotis adscencionis* and *Euphorbia origanoides*, are peculiar to the island. A dozen species of ferns inhabit the green mountain. Various plants have become naturalised.

Hemsley, W. B. Botany of the " Challenger " Expedition, Botany i., part 2, pp. 31–48, plates 16 and 17. 1884.

Gill, Mrs. Six Months in Ascension. 1885.

St. Helena.—Situated in the South Atlantic, in 15° 55′ S. latitude and 5° 42′ W. longitude, and ten miles long by eight broad, rising to a height of 2,700 feet. It is wholly volcanic, and very rugged. When first discovered, it was clothed with vegetation; but the early settlers and goats combined destroyed it all, except in a very limited area, on the highest part of the island, and its place is now occupied by plants of more vigorous constitution from various countries. English oaks, Scotch pines, and gorse are now prominent in the landscape; the last being so abundant that many of the natives obtain their living from cutting it for fuel. The original vegetation consisted almost entirely of endemic plants, some of which are quite extinct, and the remainder seemed doomed to the same fate.

Melliss, J. C. St. Helena: a Physical . . . Description of the Island . . . its Fauna and Flora. . . . London 1875. Large 8vo. pp. 426, 56 coloured plates.

Morris, D. A Report upon the present Position and Prospects of the Agricultural Resources of the Island of St. Helena, with a map showing the three zones of Vegetation. Colonial Office, 1884.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., part 2, 49–122, plates 18–22, and 48–51. 1884.

Melliss's book contains coloured figures of nearly all the indigenous flowering plants, and much information concerning their habitats. The "Challenger" Report is a complete enumeration, synonymy, &c. of all the indigenous plants; a few of which are described and figured for the first time. It also deals with the question of distribution.

Tristan da Cunha.—This, together with Inacessible and Nightingale Islands and a few outlying islets, forms a group in about 37° S. lat. and 12° W. long. The principal island has an area of only sixteen square miles, yet it rises to a height of 8,000 feet. Penguins abound, and the vegetation is sufficient to support a few cattle and sheep kept by the very small community of this remote speck of land.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., part 2, pp. 133–185, plates 25–38. 1884.

The two most prominent plants in the vegetation, *Phylica nitida*, a small tree, and *Spartina arundinacea*, a stout reed, are equally so in the distant Amsterdam Island.

Diego Alvarez, or Gough Island, in about 40° 30′ S. lat. and 10° W. long., has not been botanically explored; but a Tristan settler, who had lived for months in the island, assured Professor Moseley, that the same flowering plants, including the *Phylica*, grow there as in Tristan da Cunha.

Falkland Islands.—Situated in the South Atlantic, between 51° and 53° S. lat., and between 57° and 62° W. long. East Falkland has an area of 3,000 square miles, and West Falkland of 2,300 square miles; and the rest of the islands, about a hundred in number, have an area of nearly 1,000 square miles. Mount Adam, the highest ground in the colony, rises 2,315 feet above the level of the sea. The climate is healthy, and the range of temperature is from 30° to 50° in winter, and from 40° to 65° in summer. There are no trees, but the herbaceous vegetation is said to present a great variety of sweet-scented flowers.

Hooker, J. D. Flora Antarctica, part 2. London, 1847. 4to, with numerous plates.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., Introduction (1885), pp. 58-62.

Sir Joseph Hooker's work consists of descriptions of all the species then known (very few have been added since), and figures of a large number of them. The Botany of the "Challenger" contains a complete list, with full particulars of the distribution of all the species. There are 115 species belonging to eighty-four genera, none of which is endemic. Leguminosæ are wholly wanting, as they also are in all the islands in high southern latitudes, eastward to Macquarie and the Chatham group. *Bolax glebaria*, the Balsam-bog, and *Poa flabellata*, syn. *Dactylis cæspitosa*, the Tussock grass, are two of the most conspicuous and remarkable plants in the vegetation. The former grows in large dense hemispherical masses; and the latter is a tall elegant grass, growing gregariously and "resembling groves of miniature palms." The "tea plant," a dwarf myrtle, bears a fleshy edible fruit in great abundance, and its leaves are used as a substitute for tea. Associated with the foregoing are a dwarf *Rubus* with an edible fruit, common Thrift, and a Primrose, the only one in the southern hemisphere, and so closely allied to the British *Primula farinosa* as to have been regarded a variety of it.

South Georgia.—An uninhabited island, a dependency of the Falklands, explored and taken possession of by Captain Cook in 1775. It is situated about a thousand miles east of Cape Horn, in 54° 30′ S. lat. and 36° to 38° W. long.; and the rugged mountains are covered with permanent snows and glaciers. A German expedition for observing the transit of Venus landed there in August 1882, and remained until September 1883; and Dr. Will, one of the officers, investigated the very scanty vegetation.

Engler, A. Die Phanerogamenflora von Süd-Georgien: Jahrbücher, vi., 1886, pp. 281–285.

Hemsley, W. B. Vegetation of South Georgia: Nature, xxxiv. (1886), p. 106. A summary of the foregoing, to which is added the general distribution of all the species.

Thirteen species were collected, including the Tussock grass and the northern *Phleum alpinum*. None of the plants are peculiar to the island, and most of them have a wide range in the southern hemisphere; one, *Colobanthus subulatus*, extending from Fuegia to the Australian Alps.

7. ADEN, SOCOTRA, PERIM, AND OTHER ISLANDS OF THE RED SEA AND ARABIAN COAST.

Aden.—On the south coast of Arabia, about 100 miles eastward of the Strait of Babelmandeb, in 12° 47′ N. lat. Area about 70 square miles, and rocky and barren in the extreme. It is excessively hot, and the annual rainfall varies from six or seven inches to nothing, hence the vegetation is very sparse.

Anderson, T. Florula Adenensis: Journal of the Linnean Society, v. (1860), Supplement, pp. xxiv and 47. With six plates.

Marchesetti, C. Ein Ausflug nach Aden: Œsterreichische Botanische Zeitschrift, 1881, pp. 19–23. A sketch of the aspects of the vegetation.

Deflers, A. Herborisations dans les Montagnes Volcaniques d'Aden: Bulletin de la Société Botanique de France, xxxii. (1885), pp. 343–356; and xxxiv. (1887), pp. 61–69.

Anderson's "Florula" contains about 100 species of flowering plants, to which Deflers adds 70. There is a considerable endemic element, and some very singular plants, such as the *Adenium obesum*, the Arabic name of which is said to be "Aden."

PERIM at the mouth of the Red Sea; the Umshah group of coral reefs off the coast of Abyssinia, and the Kuriyan-Muriyan, including Hallaniya, off the south-east coast of Arabia, in about 57° E. long., are under British subjection. No record of the vegetation of any of them has been found.

ZEILA, Bulhar, Berbera, and Lasgori are British stations on the African coast, nearly opposite Aden.

SOCOTRA. — This island lies between 12° 19′ and 12° 42′ N. lat., and between 53° 20′ and 54° 30′ E. long., being about seventy-two miles from east to west, and twenty-two in breadth. It is very mountainous, though the highest peaks do not much exceed 4,000 feet. Previous to 1880 little was known of the botany, but since that date Dr. Bayley Balfour and Dr. Schweinfurth have investigated it.

Kuhn, M., and **Nordstedt, O.** Ueber Farne und Charen der Insel Socotra: Berichte der deutschen botanischen Gesellschaft, i. (1883), pp. 238–242, with woodcuts.

Balfour, I. B. On the Island of Socotra: Report of the British Association, 1881.

Balfour, I. B. The Island of Socotra and its recent Revelations: Proceedings of the Royal Institution of Great Britain, 1883.

Balfour, I. B. Botany of Socotra: Transactions of the Royal Society of Edinburgh, xxxi., 1883–8, pp. lxxv and 446, tt. 100.

Dr. Balfour estimates the known phanerogams at about 600 species. There are many singular plants among them, such as *Dendrosicyos* (an arboreous Cucurbitacea), *Adenium multiflorum*, *Dorstenia gigas*, *Dracæna*, *Aloe*, *Euphorbia* (arboreous species), and many others.

8. MAURITIUS, RODRIGUES, SEYCHELLES, AMSTERDAM, AND OTHER ISLANDS OF THE INDIAN OCEAN.

MAURITIUS.—Situated two degrees within the southern tropic, and between 19° and 20° E. long., with an area of 700 square miles, and an altitude of 2,900 feet. When first settled it was covered with forest down to the sea shore, but very little of it now remains, and introduced plants have largely replaced indigenous species.

The small islands to the northward named Gunner's Quoin, Flat Gabriel, Round, and Serpent, belong to Mauritius.

Baker, J. G. Flora of Mauritius and the Seychelles. London, 1877. 8vo. pp. 557.

The number of indigenous flowering plants described by Mr. Baker is 705; and the ferns and allies number 164, a higher proportion than in almost any other part of the world. Many of the most interesting endemic trees and shrubs, such as the *Monimiaceæ*, have been entirely exterminated or are now extremely rare. Here, as in the Seychelles, endemic species of palms and screwpines are a conspicuous feature in the scenery.

Horne, J. Notes on the Flora of Flat Island. Mauritius, 1886. Folio. pp. 4.

RODRIGUES. — Situated in 19° 41′ S. lat. and 63° 23′ E. long., and eighteen miles long by seven miles broad. It is volcanic, and the greatest altitude is a little more than a thousand feet. Formerly the island was covered with forest, but much of the native vegetation has disappeared before cultivation, and now some introduced plants are commoner than the native. Mr. J. G. Baker included Rodrigues in his "Flora of Mauritius."

Balfour, Dr. I. B. Botany of Rodrigues: Philosophical Transactions of the Royal Society of London, clxvii. (1879), pp. 302–387, tt. 19–36. There is also a separately paged reprint.

Dr. Balfour collected 189 species of flowering plants which he regarded as indigenous. Remarkable among them are three species of Palms, two Screwpines, an Aloe, and *Mathurina penduliflora*, an arboreous Turneracea, most nearly allied to the Central American *Erblichia odorata.* A marked feature in the vegetation is the great diversity in size and shape exhibited by the leaves of many plants at different periods of their growth.

CHAGOS ARCHIPELAGO.—A group of islands in the Indian Ocean, in the same longitude as the Maldive and Laccadive islands, and in about 5° S. lat. Diego Garcia, the principal island, is an atoll fourteen miles long, by six miles and a half wide, entirely of coral formation, and nowhere rising more than ten feet above high tide, excepting in a few places where the sand has drifted.

Hemsley, W. B. Report on the Vegetation of Diego Garcia: Journal of the Linnæan Society, xxii. (1886), pp. 332–340.

This report was based on collections of plants made by Mr. A. Hume and Mr. G. C. Bourne, F.L.S. They comprise thirty-six flowering plants and seven ferns, mostly of very wide distribution and none endemic. Formerly the islands were covered with forests of *Afzelia bijuga*, *Terminalia Catappa*, *Cordia subcordata*, and a few other smaller trees, but there are few large trees left now. The Coconut Palm is prominent here, as it is in most of the islands of this region.

SEYCHELLES.—A group of upwards of thirty islands, mostly very small, lying between 3° to 6° S. lat., and 900 miles north of Mauritius. Mahé has an area of 30,000 acres, is seventeen miles long, and the central mountains rise to a height of 3,000 feet. Next in size are: Praslin, 8,000 acres; Silhouette, 5,700 acres; La Digue, 2,000 acres; and Curieuse, 1,000 acres. The mountains of Silhouette are 2,500 feet high, but none of the others exceed 1,500 feet above sea-level. Bird, Frigate, Dennis, North, Aride, The Sisters, Félicité, St. Anne's, and Stag are the names of other islands of this group.

Baker, J. G. Flora of Mauritius and the Seychelles. London, 1877.

The indigenous flora of the Seychelles comprises 258 species of flowering plants and 80 ferns and lycopods, associated with which is a large number of introduced plants. Foremost in interest are the Palms, of which there are seven or eight species belonging to as many different genera, six of which are monotypic, and exclusively confined to these islands. Famous among the Palms is the Coco de Mer, or Double Coconut. The Screwpines (*Pandanus*) are abundant, and there are three or four very distinct species. One species of Pitcherplant (*Nepenthes*), a leafless Vanilla, and the Capucin tree are other interesting endemic plants.

AMIRANTES ISLANDS.—A group of small islands a little south-west of the Seychelles. The principal islands are Poivre, African, Eagle, Darros, Isle des Roches, and Boudeuse. A little farther south, in about 7° S. lat., is Alphonse Island, and eastward, in about 56° 15′ E. long., is Coetivy Island; and Platte Island is in 6° S. They produce little besides coconuts.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., Introduction, pp. 16–17.

The vegetation consists of a few species, almost all of wide range in maritime districts, and none of them endemic.

ALDEBRA.—A group of coralline islands, about 30,000 acres in extent, to the north-west of Madagascar, in about 9° 30′ S. lat. They are only about 200 feet high; the shore is fringed with mangroves, and the whole surface covered with forest which has not been botanically investigated. The group consists of West, Middle, South, and Euphrates islands.

ASSUMPTION, Astove, St. Pierre, Providence, Cerf, and Farquhar are small islands near Aldebra, concerning which little is known, though they are claimed as dependencies of Mauritius. Farther to the east is Galega or Agalega, and southward, in 15° to 17° S. lat., the Cargados or St. Brandon group, including Albatross, Tromelin, and Coco Islands.

THE GLORIOSO GROUP, much nearer Madagascar, in about 11° 20′ S. lat. and 47° 20′ E. long., is also regarded as British. They are Dulise, Verte, and Glorieuse.

THE COSMOLEDO GROUP consists of North, South, Polyte, Wizard, and Menai islands.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., Introduction, pp. 16–17.

AMSTERDAM and ST. PAUL ISLANDS.—These islands are very remote from any other land, except Kerguelen, and that is nearly 10 degrees distant. They are situated between 37° and 39° S. lat., and in about 77° 30′ E. long., and are of volcanic origin. Amsterdam is about six miles across, rising to a height of 2,760 feet; and St. Paul is about a quarter of that size, with an elevation of 840 feet.

Hooker, J. D. Enumeration of the Plants of Amsterdam and St. Paul Islands: Journal of the Linnean Society, xiv., p. 475.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., 2, pp. 259–281, tt. 41–45 and 52.

Altogether thirty-eight vascular plants are known to exist in these islands, half of which are Flowering Plants and half Ferns and Lycopods. There is no endemic genus, but nine of the species of Flowering Plants have not been found elsewhere. *Phylica nitida*, a small tree, and *Spartina arundinacea*, a reed, are the commonest plants here as well as in the Tristan da Cunha group.

KERGUELEN ISLAND.—This island is claimed as a French possession in Bayle's "Atlas Coloniale," but it does not appear to have been formally annexed. It is situated between 48° 39′ and 49° 44′ S. lat., and in 68° 30′ to 70° 30′ E. long.

Hooker, J. D. Flora of Kerguelen Island: Philosophical Transactions of the Royal Society of London, clxviii., pp. 5–93, tt. 1–5.

Hemsley, W. B. Botany of the "Challenger" Expedition, i. 2, pp. 211–281.

Vegetation sparse and wholly herbaceous, one of the commonest plants being the famous "Kerguelen cabbage," *Pringlea antiscorbutica*, which is also found in the Crozets and in Heard Island.

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9. BRITISH INDIA, EXCLUSIVE OF ISLANDS.

British India.—Including Burma, this extends from a little west of the Indus (Afghanistan and Baluchistan) to China and Siam in the east, or from about 67° to 100° E. long., and from 36° to 8° N. lat., and presents the greatest diversity of soil and climate. On the north are the highest mountains in the world, Mount Everest being a little more than 29,000 feet, or upwards of five miles and a half high.

The following statistics of the Flowering Plants in the Flora of British India appear in the Introduction to the Botany of Salvin and Godman's "Biologia Centrali-Americana." Orders, 174; genera, 2,271; species, 13,647. Of these, 304 genera and 9,370 species are endemic. The Orchideæ are the most numerous in species, considerably exceeding a thousand. Next come the Leguminosæ, followed by the Gramineæ, Euphorbiaceæ, Rubiaceæ, Compositæ, Acanthaceæ, Cyperaceæ, Labiatæ, Urticaceæ, &c., in the sequence placed.

Publications relating to India generally.

Roxburgh, W. Flora Indica, or Descriptions of Indian Plants. Serampore, 1832. 3 vols. 8vo. A second edition, edited by C. B. Clarke, Calcutta, 1874. Large 8vo, pp. 763. Reprinted literatim with references to the volumes and pages of the original.

Wight, R. Icones Plantarum Indiæ Orientalis. Madras, 1840–1853. Six vols. 4to, 2,101 plates, with descriptive letterpress.

Hooker, J. D., and **Thomson, T.** Flora Indica: being a systematic account of the Plants of British India. London, 1855. Vol. i. Ranunculaceæ to Fumariaceæ, with an Introductory Essay: all that has appeared. 8vo. pp. 280 and 285, with a map. Valuable for the Essay.

Balfour, E. Cyclopædia of India . . . . . Products of the . . . . . Vegetable Kingdom. Madras, 1857. 8vo.

Beddome, R. H. The Ferns of British India, being Figures and Descriptions of Ferns from all parts of British India (exclusive of those figured in the "Ferns of Southern India and Ceylon"). Madras, 1865–1870. 4to. 345 plates, with descriptive letterpress.

Day, K. L. The Indigenous Drugs of India. Calcutta, 1867. 8vo.

Watson, J. F. List of Indian Products (the Vegetable Products, by M. C. Cooke). London, 1872. 4to.

Drury, H. The Useful Plants of India. 2nd edition. London, 1873. 8vo. pp. 512.

Balfour, E. Timber Trees of India, &c. Madras, 1870, ed. 3. 8vo.

Hooker, J. D. Flora of British India. London, 1875–1887. 8vo. Vols. i.–iv. completed, vol. v. in course of being issued, bringing the work down to the Orchid.

Clarke, C. B. Compositæ Indicæ. Calcutta, 1876. 8vo.

Beddome, R. H. Supplement to the "Ferns of Southern India" and the "Ferns of British India," containing a revised list of all the species and 45 plates of previously unfigured species. Madras, 1876. 4to.

Oliver, D. First Book of Indian Botany. London.

Gamble, J. S. A Manual of Indian Timbers. Calcutta, 1881. 8vo. pp. 522, with a map showing the mean annual distribution of the rainfall.

Beddome, R. H. Handbook to the Ferns of British India, Ceylon, and the Malay Peninsula. Calcutta, 1883. Small 8vo. pp. 500, with 300 illustrations.

King, G. The species of Ficus of the Indo-Malayan and Chinese Countries. Annals of the Royal Botanic Garden, Calcutta, vol. i. 1886–8. 4to. pp. 185, tt. 225.
A similar work, by the same author, on the oaks of this region is in the press.

Hemsley, W. B. Biologia Centrali-Americana, Botany, i. "Introduction" (1888), pp. xiv–xxvi. A statistical comparison of the flora of India with the floras of Australia and Mexico.

NORTH-WESTERN INDIA.

Thomson, T. Western Himalaya and Tibet. London, 1852. 8vo. pp. 501, illustrated.

Stewart, J. Lindsay. Punjab Plants, comprising Botanical and Vernacular Names and Uses of most of the Trees, Shrubs, and Herbs of economical value growing within the Province. Lahore, 1869. 8vo. pp. 375.

Aitchison, J. E. T. Catalogue of the Plants of the Punjab and Sindh. London, 1869. 8vo.

Atkinson, E. T. Economic Products of the North-western Provinces, 1876–1881.

Stewart, J. Lindsay, and **Brandis, D.** The Forest Flora of North-west and Central India. London, 1874. 8vo. pp. 608.

Stewart, J. Lindsay, and **Brandis, D.** Illustrations of the Forest Flora of North-west and Central India, drawn by W. H. Fitch. London, 1874. 4to. 72 plates.

Duthie, J. F. Illustrations of the Indigenous Fodder Grasses of the Plains of North-western India. Roorkee, 1886. Folio. 40 plates.

Dr. Aitchison's reports on the botanical collections he made during the Afghan campaign and while attached to the Boundary Commission will be found useful. They appeared in the Journal of the Linnean Society, vols. xviii. and xix., and Transactions, 2nd series Botany, vol. iii.

BENGAL, &C.

Hooker, J. D. Himalayan Journals. London, 1854. Two vols. 8vo, illustrated.

Hooker, J. D. Rhododendrons of Sikkim-Himalaya. London, 1849–51. Folio. 30 coloured plates and text.

Clarke, C. B. Commelynaceæ et Cyrtandraceæ Bengalenses. Calcutta, 1874. Folio. 93 plates, with descriptive letterpress.

Hunter, W. W. A Statistical Account of Bengal. London, 1877. 8vo. Vol. xx. (pp. 121–227) contains a catalogue of the Plants of Bengal, by Dr. G. King.

Clarke, C. B. On the Ferns of Northern India: Transactions of the Linnæan Society, n. s. Botany, i., pp. 425–611, tt. 49–84.

Blandford, H. F. Ferns of Simla: Journal of the Asiatic Society of Bengal, 1889, lvii., 2, pp. 294–315.

Clarke, C. B. On the Plants of Kohima and Muneypore: Journal of the Linnean Society, xxv., 1889, pp. 107, tt. 1–44.

BOMBAY.

Dalzell, N. A., and **Gibson, A.** The Bombay Flora, or short Descriptions of all the Indigenous Plants. Bombay, 1861. Small 8vo. pp. 332. Supplement, pp. 112.

Birdwood, G. C. M. Catalogue of the Vegetable Productions of the Presidency of Bombay. Bombay, 1865, ed. 2. 8vo.

Campbell, J. M. Gazetteer of the Bombay Presidency, Botany, vol. xxv. Bombay, 1886.

MADRAS.

Wight, R. Illustrations of Indian Plants. Madras, 1840–1850. Two vols. 4to, 182 coloured plates and letterpress.

Beddome, R. H. The Ferns of Southern India, being Descriptions and Plates of the Ferns of the Madras Presidency. Madras, 1863. 4to, 271 plates with descriptive letterpress.

Beddome, R. H. The Flora Sylvatica for Southern India. Madras, 1869–1874. Two vols. 4to, consisting of 330 plates and descriptive letterpress.

Beddome, R. H. The Forester's Manual of Botany for Southern India. Madras, 1874. 4to. pp. 238, with 29 plates of analyses of Genera.

Beddome, R. H. Icones Plantarum Indiæ Orientalis, or Plates and Descriptions of New and Rare Plants from Southern India and Ceylon. Madras, 1874. 4to, 300 plates and descriptive letterpress.

BURMA.

Kurz, S. Forest Flora of British Burma. Calcutta, 1877. Two vols. 8vo.

Mason, F. Burma, its People and Productions, or Notes on the Fauna, Flora, and Minerals of Tenasserim, Pegu, and Burma. Hertford, 1883. Vol. ii., Botany, by W. Theobald. 8vo. pp. 787.

[An account is in preparation of a highly interesting collection of plants, made by General Collett, in the Shan States, Upper Burma. It will probably appear in the Journal of the Linnean Society.]

10. CEYLON, LACCADIVES, MALDIVES, ANDAMANS, NICOBARS, STRAITS SETTLEMENTS, KEELING OR COCOS ISLANDS, CHRISTMAS ISLAND, BRITISH NORTH BORNEO, HONGKONG, AND PORT HAMILTON.

CEYLON.—Situated between 6° and 10° N. lat. and 79° and 82° E. long., with an extreme length, from north to south, of 266 miles, and an area of 24,702 square miles. There is a central mountain range rising to a height of upwards of 8,000 feet. Vegetation luxuriant and varied, and containing a large number of endemic forms.

Ferguson, W. A descriptive list of Ceylon Timber Trees, reprinted from Ferguson's Ceylon Directory for 1863, pp. 225–257.

Thwaites, G. H. K. Enumeratio Plantarum Zeyloniæ. London, 1864. 8vo. pp. 483.

Trimen, H. Systematic Catalogue of the Flowering Plants and Ferns of Ceylon. Colombo, 1885. 8vo. pp. 137.

Trimen, H. Notes on Ceylon Plants: Journal of Botany, 1885 and 1889. A series of descriptive papers.

Ceylon Vegetable Products. Handbook for Ceylon. Colonial and Indian Exhibition, 1886.

The plants of Ceylon are also included in Hooker's "Flora of British India." About 3,000 species are recorded, and they are referred to 1,070 genera and 156 natural orders. The almost exclusively Asiatic order, Dipterocarpeæ, is very largely developed in the island, and nearly all of the species are endemic. There is one species of *Nepenthes* (Pitcher Plant), and one species of the essentially Australian genus, *Stylidium*.

LACCADIVE and MALDIVE ISLANDS.—A chain of low islands lying to the west of India and stretching from about 13° N. to 1° S. lat. The largest of the thirty-two islands of the former group is seven miles long and two and a half broad; and Mali, the largest in the latter, is seven, miles in circumference. There are seventeen groups of the Maldives. The indigenous vegetation is doubtless very scanty and poor in species, but there appears to be no record of the plants of these islands. There are a few plants from the Laccadives in the Kew Herbarium.

ANDAMAN and NICOBAR ISLANDS.—A chain of Islands, opposite the coast of Martaban, in the Indian Ocean, between 7° and 14° N. lat., and 92° to 94° E. long. The principal islands, proceeding from north to south, are North Andaman, Middle Andaman, and South Andaman (which are only separated by narrow channels), Little Andaman, Kar Nicobar, Kamorta, Katchal, Little Nicobar, and Great Nicobar. Among the smaller ones are: Great Cocos, Little Cocos, Landfall, Interview, Sound, Barren, Chatham, North Sentinel, South Sentinel, Cinque, Passage, Sisters, Brothers, Batti Malve, Tillandyong, Chowrey, Bompoka, Teressa, Trinkut, and Meroe. These islands, which nowhere attain a sufficient elevation to affect materially the character of the vegetation, have only been very partially explored botanically.

Kurz, S. Report on the Vegetation of the Andaman Islands. Calcutta, 1870. Folio. pp. 75.

Kurz, S. Descriptions of New Plants from the Nicobar and Andaman Islands: Journal of Botany, 1875, pp. 321–333, tt. 169–171.

Kurz, S. A Sketch of the Vegetation of the Nicobar Islands: Journal of the Asiatic Society of Bengal, xlv. (1876), 2, pp. 105–164, tt. 12–13.

Kurz collected 596 species of flowering plants in the Andamans, 520 of which he regarded as indigenous, and 34 are described as new. They are distributed among 300 genera, none of which is peculiar to the islands. The enumeration of Nicobar Plants, flowering plants and ferns, contains 624 species, some of which are obviously colonists.

Straits Settlements.—Under this denomination are included the Island of Penang, the Province of Wellesley on the mainland opposite, the Dindings and Perak, Malacca, Singapore, and the Keeling or Cocos Islands.

Although these regions were more or less explored by the early Indian botanists, there has been no separate publication on their vegetable products. They are included in the "Flora of British India," and much of the arboreous element is described in Kurz's "Forest Flora of British Burma." Kurz also gives a list of the plants of Singapore in the Report, cited above, on the vegetation of the Andaman Islands.

Penang, or Prince of Wales Island, is about 106 square miles in extent, with a range of hills 2,400 feet high. It is 360 miles from Singapore, in about 5° N. lat. and 100° E. long. The Province of Wellesley, on the mainland opposite, is about 45 miles in length, by eight to ten in breadth.

Malacca is situated on the mainland between Penang and Singapore. It is in about 2° 10′ N. lat. and 102° 14′ E. long., and has an area of 659 square miles.

Singapore is an island about twenty-seven miles long, by fourteen wide, embracing an area of 206 square miles. The surface is undulating, and 50 to 200 feet above the level of the sea. Singapore town is in 1° 16′ N. lat. and 103° 53′ E. long.

Perak.—The protected State of Perak is situated between 3° 45′ and 5° 29′ N. lat., and 100° 22′ to 101° 40′ E. long., with an estimated area of 7,949 square miles, and a maximum elevation of between 7,000 and 8,000 feet. Vegetation rich and varied, including a large endemic element. A few odd plants have been published in Hooker's Icones Plantarum and the Journal of Botany for 1887. Sir Joseph Hooker and Dr. G. King are engaged upon a Flora of the region; meanwhile Kurz's Forest Flora of British Burma will be found useful.

Selangor and Sungei Ujong are protected States lying to the south of Perak, the former having an area of about 3,000 square miles, and the latter about 660. There are no special reports on the vegetation.

Keeling or Cocos Islands.—A group of small islands 600 miles distant from Java, the nearest land, in about 12° S. lat. and 97° E. long. They contain large plantations of coconut palms, the cultivation of which is the only industry. Darwin visited them in 1836, H. O. Forbes in 1878, and Dr. Guppy in 1888. The largest island is about five miles long and a quarter of a mile broad.

Henslow, Rev. J. S. Florula Keelingensis: Annals of Natural History, i., 1838, pp. 337–347. Plants collected by Darwin.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., part 3, p. 113. List of the plants collected by Darwin, with remarks on their distribution.

Forbes, H. O. List of Plants observed in the Keeling Islands: A Naturalist's Wanderings in the Eastern Archipelago, 1885, pp. 42–43.

At the time Darwin visited the group there were considerable woods of *Cordia subcordata* and *Pemphis acidula*, but in 1878 they had almost wholly disappeared, and the ground was occupied by coconut palms. Darwin collected nineteen species of flowering plants, to which Forbes added a few more herbaceous species. None of the plants are endemic; the two described by Henslow as new proving to be forms of widely dispersed species.

Dr. Guppy is engaged upon a much fuller account of the vegetation than has hitherto appeared.

CHRISTMAS ISLAND.—A small rocky island 1,580 feet high, about 12 miles across, and 200 miles from the nearest point of Java, in about 10° 30′ S. lat. and 106° E. long. It is densely wooded, and some of the trees are of large dimensions. The flora is essentially the same as that of the nearest Malayan islands, with a few peculiar species.

Hemsley, W. B. Report on the Vegetation of Christmas Island. Indian Ocean: Journal of the Linnæan Society, xxv. (1889).

LABUAN.—An island on the north-west coast of Borneo, situated in about 5° 20′ N. lat., and 115° 20′ E. long., with an area of 30 square miles. Mr. James Motley made a considerable collection of plants in the island many years ago, and they are in the Kew Herbarium, but no list of them has been published. It is now included in the territory of British North Borneo.

BRITISH NORTH BORNEO or SABAH.—This comprises an area of 31,000 square miles, lying between 4° and 7° 30′ N. lat., and about 115° 8′ to 119° 16′ E. long. The country is densely clothed with vegetation, and there is much valuable timber, though botanically it is little known.

Miquel, F. A. W. Flora Indiæ Batavæ. Amsterdam, 1855. 3 vols. 8vo.

Beccari, O. Malesia: Raccolta di Osservazioni Botaniche intorno alle Piante dell' Arcipelago Indo-Malese e Papuano. Genoa, 1877 to 1887. 4to. 3 vols., illustrated.

Burbidge, F. W. The Gardens of the Sun, or a Naturalist's Journal on the mountains and in the forests and swamps of Borneo. London, 1880. 8vo. pp. 364, illustrated. Contains much interesting matter relating to the vegetation of North Borneo.

Alcock, Rutherford. Handbook of British North Borneo, Indian and Colonial Exhibition, 1886.

Baker, J. G. The Ferns of North Borneo: Journal of the Linnæan Society, xxii., pp. 222–232. 1886.

Among the larger islands of the territory are Labuan, Balambangan, Banguez, Jambongon, Timbu Mata, Sebattik, East Noenoekan, Kali Babang, Gaya (East), Tambisan, Mallawalle, Gaya (West), and Shoal.

HONGKONG.—Situated at the mouth of the Canton river, China, between 22° 1′ and 22° 9′ N. lat., and between 114° 5′ and 114° 18′ E. long. It is very irregular in outline and surface, and has an area of a little more than 29 square miles, and a maximum elevation of between 1,700 and 1,800 feet. The opposite peninsula of Kowloon forms a part of the same colony. The deep narrow ravines of Hongkong shelter a rich and extremely varied vegetation, and many of the genera and species have hitherto not been found elsewhere.

Bentham, G. Flora Hongkongensis. London, 1861. 8vo. pp. 482, with a map of the island.

Hance, H. F. Floræ Hongkongensis Supplementum: Journal of the Linnæan Society, xiii. (1873), pp. 95–144.

Ford, C. List of Additions to the Hongkong Flora: Report to His Excellency the Governor, 1885, Appendix, pp. 2.

Forbes, F. B., and Hemsley, W. B. Index Floræ Sinensis: Journal of the Linnæan Society, xxiii., 1886–1888, and xxvi., 1889, not yet completed.

Bentham enumerates a thousand species belonging to 550 genera and 125 natural orders; and the proportion of woody to herbaceous species is as 1 to 2·1. Out of the thousand species, 160 had not, at that date, been found elsewhere, and although recent explorations in various parts of the mainland have revealed the existence of some of them in other localities, the majority are still only known to inhabit Hongkong. Nearly 200 species have been added to the flora since the publication of Bentham's book.

Port Hamilton.—A small island off the south coast of Corea, in 34° N. lat. and about 127° 20′ E. long. Charles Wilford made a small collection of dried plants in the island in 1859, and they are included in the "Index Floræ Sinensis" cited above. The British establishment has recently been withdrawn from the island.

11. AUSTRALIA, TASMANIA, NEW ZEALAND, NEW GUINEA, AND NORFOLK ISLAND, WITH THE SMALLER NEIGHBOURING ISLANDS.

Australia.—Excluding Tasmania, Australia stretches through about twenty-nine degrees of latitude, from 10° S. lat., and from about 115° to 154° E. long., with an area of 2,989,000 square miles, being rather more than two-thirds the size of Europe. There are few large rivers, and an immense tract of the interior is almost absolute desert, while the mountains, the highest of which are in the east and south-east, nowhere rise above 6,500 feet.

Mueller, F. Fragmenta Phytographiæ Australiæ. Melbourne, 1858–1881. Eleven vols. 8vo, some of them illustrated.

Bentham, G., and **Mueller, F.** Flora Australiensis. London, 1863–78. Seven vols. 8vo.

Mueller, F. Introduction to Botanic Teachings at the Schools of Victoria. Melbourne, 1877.

Mueller, F. Eucalyptographia. A descriptive Atlas of the Eucalypts [Gum-trees] of Australia and the adjacent Islands. Melbourne, 1879–84. 4to. 100 plates, with descriptive letterpress.

Bailey, F. M. The Fern World of Australia. Brisbane, 1881. 8vo. pp. 105.

Fitzgerald, R. D. Australian Orchids. Sydney, 1882–1888. Folio, two vols., the second not yet completed. Elaborate illustrations.

Mueller, F. Iconography of Australian species of Acacia and cognate genera. Melbourne, 1887–8. 4to, 130 plates.

Mueller, F. Illustrations of Myoporineous Plants. Melbourne, 1886. 4to. 74 plates.

Mueller, F. Systematic Census of Australian Plants. Melbourne, 1882–9. 4to. pp. 152, with four supplements.

Maiden, J. H. The useful Native Plants of Australia and Tasmania, 1889. 8vo. pp. 696.

The recorded Flowering Plants and Ferns of the whole of Australia number about 8,900 species, of which upwards of 7,600 are peculiar to the country. They belong to 1,394 genera and 149 natural orders. Small, hard leaves and brilliantly coloured flowers abound. Specially characteristic of this Flora are the capsular Myrtaceæ (including the Gum-trees—*Eucalyptus*), Leguminosæ (including the phyllodineous Acacias), Proteaceæ, Pittosporeæ, Myoporineæ, and Grass trees—*Xanthorrhœa.*

NEW SOUTH WALES.—On the eastern side of Australia, extending from about 29° to 37° S. lat., and westward to the 141st meridian of E. long., the area being estimated at 310,700 square miles. The Murray river on the south forms the boundary of Victoria. Mount Sea View, at the junction of the Liverpool and New England ranges of hills, reaches a height of 6,000 feet.

Moore, C. Woods of New South Wales. Sydney, 1871. 8vo.

Woolls, W. Plants indigenous in the neighbourhood of Sydney. Sydney, 1880. 8vo. pp. 59.

LORD HOWE'S ISLAND.—About 300 miles east of Port Macquarie, N. S. Wales, in 159° E. long. and 32° S. lat. It is seven miles in length, with an average breadth of one mile, and the mountains rise to a height of nearly 3,000 feet. Of volcanic origin, with an exceedingly fertile soil, and everywhere covered with a dense vegetation.

Moore, C. Sketch of the Vegetation of Lord Howe's Island: A report to the Governor of New South Wales, fol., pp. 4, 1869.

The flora of this island is bracketed with N. S. Wales in Bentham's "Flora Australiensis." It is similar in character to that of Norfolk Island, though the genus Araucaria and the order Coniferæ are wholly wanting. Palms are conspicuous, consisting of three endemic species, namely, *Kentia Belmoreana*, *Kentia Canterburyana*, and *Clinostigma Mooreanum*. The commonest trees are *Hibiscus Patersonii*, *Myoporum acuminatum*, and *Ochrosia elliptica*. Capsular Myrtaceæ are represented by one species each of *Melaleuca* and *Leptospermum*, and Epacrideæ by one *Dracophyllum*. Proteaceæ are wholly wanting, and Leguminosæ nearly so; among the few of this order is one species of the otherwise New Zealand genus *Carmichaelia*.

BALLS PYRAMID is a small island between Norfolk Island and Lord Howe's Island.

QUEENSLAND.—This Colony occupies the whole of north-eastern Australia, from Cape York to Point Danger, the northern boundary of New South Wales, and it extends westward to 138° E. long. The total area is estimated at 668,497 square miles; and it is about 1,300 miles from north to south and 900 miles in its greatest breadth.

Bailey, F. M. Handbook of the Ferns of Queensland. Brisbane, 1874. Small 8vo. pp. 72, and 22 pages of figures.

Bailey, F. M. Illustrated Monograph of the Grasses of Queensland. Brisbane, 1878. 1 vol. folio.

Bailey, F. M., and **Tenison-Woods, J. E.** A Census of the Flora of Brisbane: Proceedings of the Linnæan Society of New South Wales, iv. (1880), pp. 117–204. Orders, 123; genera, 633; species, 1,228.

Bailey, F. M. A Synopsis of the Queensland Flora, containing both Phœnogamous and Cryptogamous Plants. Brisbane, 1883. 8vo. Supplement 1, 1886; 2, 1888.

Bailey, F. M. The Flora of Queensland: a Sketch. London, 1886 (Colonial and Indian Exhibition). 8vo. pp. 14.

SOUTH AUSTRALIA.—This Colony stretches all across the continent of Australia, between 129° to 138° E. long. in the northern part, and 129° to 141° in the southern part of its area, the whole of which is computed at 900,000 square miles; and it is nearly 1,900 miles from north to south. But most of the works relating to the botany, &c. (including Bentham's "Flora Australiensis") deal only with the original area from the 26th parallel of S. lat. southward.

Schomburgk, R. The Flora of South Australia. (From the Handbook of South Australia.) Adelaide, 1875. 8vo. pp. 64.

Tepper, O. On the Characteristics and Distribution of the Native and Naturalized Plants about Ardrossan, Yorke's Peninsula. Adelaide, 1880. 8vo.

Tate, Ralph. A Census of the Indigenous Flowering Plants and Ferns of extratropical South Australia: Transactions of the Philosophical Society of Adelaide, 1880. Reprint, 8vo. pp. 45.

Brown, J. E. Forest Flora of South Australia. Adelaide, 1882–9. Large folio, coloured illustrations, not yet completed.

KANGAROO ISLAND.—Situated at the entrance to St. Vincent Gulf, South Australia. About 90 miles in length, running east and west, and 25 miles in its greatest breadth, with an area of 1,500 square miles. The surface is undulating, but the elevation nowhere exceeds 1,000 feet.

Tate, R. The Botany of Kangaroo Island: Transactions of the Royal Society of South Australia, 1883. Reprint, small 8vo. pp. 56, with map.

Tate enumerates 414 species of vascular plants belonging to 230 genera and 69 natural orders. The number of peculiar species is small, and many West Australian and Tasmanian plants here find their eastern and western limits respectively.

VICTORIA.—The smallest of the Australian Colonies, yet nearly equalling Great Britain in area. Its greatest length is about 490 miles, and its greatest breadth 300 miles, and it abuts on New South Wales to the north and South Australia to the west. The "Alps" are the highest mountains in Australia, reaching very nearly 6,500 feet.

Mueller, F. The Plants Indigenous to the Colony of Victoria. Lithograms. Melbourne, 1864–65. 4to. 71 and 18 supplemental plates. The descriptive letterpress of this work has only been published as far as the end of the Thalamifloræ.

The tallest Gum-trees, and the tallest trees in the world, are found in some of the gullies of Victoria. Several trees have been measured that were more than 400 feet high, and the highest was 471 feet.

WESTERN AUSTRALIA.—This includes the whole of the continent westward of the 129th meridian of E. long., and has an area of 1,060,000 square miles, though only a comparatively small portion of it is settled, and immense tracts have not been explored. In Bentham's "Flora Australiensis" all the country north of the tropic of Capricorn is reckoned to his "North Australia," which in like manner includes the tropical part of the Colony of South Australia.

Drummond, J. Vegetation of West Australia. Hooker's Journal of Botany, ii. (1840), pp. 343–372; iv. (1842), pp. 79–86. Hooker's London Journal of Botany, i. (1842), pp. 86–97, 215–217, 397–398, 626–635; ii. (1843), pp. 167–183; iii. (1844), pp. 263–266, 300–314. Hooker's Kew Journal of Botany, i. (1849), pp. 247–251, 374–377; ii. (1850), pp. 30–32; iv. (1852), pp. 181–189; v. (1853), pp. 115–122, 139–145, 177–183, 312–315, 344–347, 398–406.

Mueller, F. A Catalogue of Plants collected during Mr. Alexander Forest's Geographical Exploration of North-west Australia.

Mueller, F. Forest Resources of Western Australia. London, 1879. 4to. pp. 30, tt. 20.

Mueller, F. The Plants indigenous around Sharks Bay and its vicinity. Perth, 1883. Folio. pp. 24.

The Flora of Western Australia is one of the most highly specialized in the world, if not the most highly specialized, for out of 3,136 species of Flowering Plants and Ferns recorded in 1886, 2,680 are endemic. Many of the species are extremely rare and local, and will doubtless disappear altogether as cultivation extends.

TASMANIA. Situated to the South of Australia (from which it is divided by Bass's Straits, 120 miles wide), between about 39° 40′ and 43° 40′ S. lat., and 143° 45′ to 148° 20′ W. long., with an estimated area of 26,172 square miles. This includes the adjacent islands, fifty-five in number, which are mostly in Bass's Straits. The largest are King, Flinders, and Cape Barren Islands. Tasmania, or Van Diemen's Land, itself is undulated and well watered, many of the mountain peaks reaching an altitude of between 4,000 and 5,000 feet, and two or three slightly exceed 5,000 feet.

Tasmania is included in Bentham's "Flora Australiensis."

Hooker, J. D. Flora Tasmaniæ. London, 1855–60. Two vols. quarto, with 200 coloured plates.

Whiting, G. Products and Resources of Tasmania—Vegetable Products, by W. Archer. Hobart, 1862. 8vo.

Mueller, F. Contributions to the Phytography of Tasmania: Proceedings of the Royal Society of Tasmania, in several volumes.

Spicer, W. W. Handbook of the Plants of Tasmania. Hobart, 1878. 8vo.

Mueller, F. Census of the Plants of Tasmania: Proceedings of the Royal Society of Tasmania, 1879, Appendix, pp. 32.

Mueller, F. Vegetation of King Island: Proceedings of the Royal Society of Tasmania, 1881, pp. 46–48.

Mueller, F. Enumeration of the plants of Deal Island, Kent's group: Proceedings of the Royal Society of Tasmania, 1884, pp. 282–3.

The Flora of Tasmania is quite Australian in character, including the characteristic gum-trees. Mueller records 945 species of Flowering Plants, belonging to 363 genera and 88 natural orders. In the very different Flora of New Zealand the numbers are nearly the same, except of genera, of which there are only 306.

NEW ZEALAND.—Extends through about thirteen degrees of latitude, from 34° to 47° 15′ S., and from 166° 30′ to 178° 30′ E. long., and the total area is about 10,400 square miles. The mountains in the southern island, especially on the western side, reach great altitudes, Mount Cook exceeding 12,000 feet.

Hooker, J. D. Flora Novæ Zealandiæ. London, 1852–1855. 2 vols. 4to, with 130 plates.

Hooker, J. D. Handbook of the New Zealand Flora. London, 1864. 8vo. pp. 798.

H. E. S. L. Ferns which grow in New Zealand and the Adjacent Islands, plainly described. Auckland, N.Z., 1875.

Buchanan, J. The Indigenous Grasses of New Zealand. Wellington, 1880. Folio, sixty-four plates with descriptive letterpress.

Buchanan, J. Manual of the Indigenous Grasses of New Zealand. Wellington, 1880. An octavo edition of the preceding.

Petrie, D. A visit to Stewart Island, with Notes on its Flora. Transactions of the New Zealand Institute, xiii., 1880, pp. 323–332.

Kirk, T. On the Flowering Plants of Stewart Island: Transactions of the New Zealand Institute, xvii., 1884, pp. 213–228.

Kirk, T. On the Ferns of Stewart Island. Loc. cit. pp. 228–334.

Kirk, T. The Forest Flora of New Zealand. Wellington, 1889. Folio. pp. 345, tt. 142.

Since the publication of the "Handbook of the New Zealand Flora" a number of distinct new species have been discovered and described, chiefly in the "Transactions and Proceedings of the New Zealand Institute." Many very slight variations from the established species have also been described as species.

The native vegetation is abundant and often luxuriant, yet it is composed of a comparatively small number of species; less than a thousand species of flowering plants being recorded. In contrast to this it may be mentioned that the Flora of Japan (a country occupying a situation in the northern hemisphere similar to that of New Zealand in the southern) comprises considerably more genera than there are species in New Zealand, and about three times as many species.

The forests of New Zealand consist to a great extent of various kinds of Beech (*Fagus*) and Pine (*Podocarpus*, *Dacrydium*, &c.); and the herbaceous vegetation contains a large number of endemic species of such common European genera as *Ranunculus*, *Epilobium*, and *Veronica*. *Fuchsia* and *Calceolaria*, otherwise restricted to America, are represented by two or three species each. The Leguminosæ are very few and peculiar. Various Coniferæ, a laurel, one or two Proteaceæ, and *Atherosperma novæzelandiæ* are among the best timber trees. Many English weeds have become very common.

Ferns are very numerous and varied, and include eight or ten arboreous species.

Kermadec Islands.—A chain of widely separated islands, between 500 and 600 miles to the north-east of New Zealand, situated between 29° and 32° S. lat., and 178° to 180° W. long. The principal islands are Raoul, or Sunday, and Macaulay; Curtis and Esperance being little more than rocks. Sunday Island has an estimated area of 7,260 acres, rises to a height of 1,720 feet, and is clothed with forest from the sea coast to the top of the mountains.

Hooker, J. D. On the Botany of Raoul Island: Journal of the Linnæan Society, i. (1857), pp. 125–129.

Cheeseman, T. F. On the Flora of the Kermadec Islands: Transactions of the New Zealand Institute, xx., 1887, pp. 151–181.

Hemsley, W. B. The substance of the foregoing with a commentary thereon. "Nature," xxxviii., p. 622.

The vegetation of the Kermadec Islands consists almost entirely of plants common to New Zealand, though the commonest tree, Metrosideros polymorpha, which is all over Polynesia, and a palm, which is the same as that inhabiting Norfolk Island, are not natives of New Zealand. Cheeseman enumerates 115 vascular plants.

Chatham Islands.—Situated about 560 miles east of New Zealand, between 43° and 45° S. lat., and 176° to 177° W. long. Chatham Island has an area of 305,280 acres, of which 57,800 are lakes and lagoons. Pitt Island is 12 miles long by eight broad. The vegetation is very similar to that of New Zealand, and a few of the same plants also occur in Norfolk Island.

Hooker, J. D. Handbook of the New Zealand Flora. London, 1864. 8vo. pp. 798.

Mueller, F. The Vegetation of the Chatham Islands. Melbourne, 1864. 8vo. 86, with seven plates.

Buchanan, J. On the Flowering Plants and the Ferns of the Chatham Islands: Transactions and Proceedings of the New Zealand Institute, vii., 1875, pp. 333–341.

The later enumeration contains 205 species of Flowering Plants and Ferns, belonging to 129 genera. Out of this number, 191 are common to New Zealand, leaving only 13 peculiar to these islands. Remarkable among the endemic plants are *Olearia Traversii* and *Senecio Huntii*, arboreous members of the Compositæ, from 20 to 30 feet high, with a trunk sometimes as much as two feet in diameter. *Myosotidium nobile*, a giant kind of Forget-me-not, is also noteworthy as an ornamental plant. There are no Myrtaceæ, and the Leguminosæ are only represented by *Sophora tetraptera*. The New Zealand palm, *Rhopalostylis sapida*, syn. *Areca sapida*, and the New Zealand Flax, *Phormium tenax*, extend to the Chatham Islands.

Antipodes Island.—A very small island in 179° E. long. and in about 49° 30′ S. lat. Nothing is known of its vegetation.

Bounty Island.—In about the same longitude as the last, and in 47° 30′ S. lat., and equally unknown botanically.

Auckland Islands.—This group lies in about 50° S. lat. and 166° E. long., and is about four miles long by two and a half broad. The herbaceous and shrubby vegetation is almost identical with that of Campbell Island, in addition to which there is an arboreous belt on the sea shore. Since the publication of Sir Joseph Hooker's work, cited under Campbell Island, a somewhat augmented list has appeared.

Kurtz, F. Ueber eine auf den Aucklandinseln gemachte Pflanzen-Sammlung: Sitzungsberichte des botanischen Vereins der Provinz Brandenburg, 1876, pp. 3–12.

The trees consist almost entirely of a Myrtacea (*Metrosideros lucida*), 20 to 40 feet high, with trunks two to three feet in diameter. Associated with this are species of *Coprosma*, *Panax* and *Veronica* and the tree-like Epacridea, *Dracophyllum longifolium*.

Campbell Island.—Situated in 52° 30′ S. lat. and 169° E. long., and 30 miles in circumference, with elevations up to 1,500 feet. There are no trees, and the vegetation is almost entirely herbaceous and remarkable for the showy character of many of the plants. The flora is fully elaborated, and many of the plants figured, in Hooker's "Flora Antarctica," and it is also included in the same author's "Handbook of the Flora of New Zealand."

Hooker, J. D. Flora Antarctica, part I. London, 1844. 4to. pp. 208, tt. 110.

Kirk, T. Notes on Plants from Campbell Island: Transactions of the New Zealand Institute, xiv. (1881), pp. 387–389.

Buchanan, J. Campbell Island and its Flora: Transactions of the New Zealand Institute, xvi. (1883), pp. 398–400.

Conspicuous among the plants giving colour to the vegetable carpet are brilliant purple flowered species of *Celmisia* and *Pleurophyllum*, which Buchanan observes may be regarded as the gems of the southern Flora. *Chrysobactron Rossii*, a liliaceous plant with bright yellow flowers, is also very showy.

MACQUARIE ISLAND.—This is the most southerly of the islands in the New Zealand region, lying about 600 miles to the south-west of the mainland, in 54° 30′ S. lat. and 159° E. long. The surface is hilly, though the greatest elevation is probably not more than 600 to 700 feet, and the vegetation is very sparse, consisting entirely of herbaceous plants.

Scott, J. H. Macquarie Island: Transactions of the New Zealand Institute, xv. (1882), pp. 484–493.

Hemsley, W. B. Botany of the "Challenger" Expedition, Introduction, 1885, pp. 62–65. The substance of the foregoing, with fuller particulars of the general distribution of the plants.

Altogether 18 flowering plants and ferns are known to inhabit this island, whereof 12 also occur in New Zealand, while of the remaining six, three inhabit the Auckland and Campbell Islands, and the others extend westward to the Crozets, Kerguelen, and Fuegia.

NEW GUINEA.—Excepting Australia, this is the largest island in the world, extending from 130° 50′ to 150° 35′ E. long., and from near the equator to 10° 40′ S. lat., the estimated area being 325,000 square miles. Its greatest length is 1,490 miles, and its greatest breadth 430 miles. Very little is known of the interior, but there are very lofty mountains, rising in some parts to a height of 17,000 or 18,000 feet. The south-eastern portion, from the 141st parallel of longitude eastward, an area of 88,000 square miles, is British. Judging from the samples of the vegetation that have come under the observation of botanists, and from the descriptions of travellers, the flora is an exceedingly rich one, abounding in peculiar types, more Asiatic than Australian in character, though there is a considerable intermingling of the Australian element.

D'Albertis, L. M. New Guinea: What I did and what I saw. London, 1880. 2 vols. 8vo, with illustrations and a map.

Mueller, F. Descriptive Notes on Papuan Plants. Melbourne, 1875–1885. Small 8vo. Eight parts, vol. i., pp. 117; vol. ii., pp. 52.

Beccari, O. Malesia: Raccolta di Osservazioni Botaniche intorno alle Piante dell' Arcipelago Indo-Malese e Papuano. Genoa, 1877–1887. 4to. 3 vols., illustrated.

The Louisiade Archipelago, and the Trobirand, Woodlark, and D'Entrecastreaux groups of islands, to the east of New Guinea, have been declared under British protection. Next to nothing is known of the vegetable productions of these islands.

NORFOLK ISLAND.—About seven miles long and four broad, with a maximum elevation of 1,200 feet; situated in about 29° S. lat. and 168° E. long. Philip Island, which is very much smaller in extent, is on the same meridian, and about five miles south. There is one peak here upwards of 900 feet high.

Endlicher, S. Prodromus Floræ Norfolkicæ. Vienna, 1833. Small 8vo. pp. 100.

Cunningham, A. Notes on the vegetation of Norfolk and Philip Islands, with a list of species not included by Endlicher: Hooker's London Journal of Botany, i. (1842), pp. 111–124.

Backhouse, J. Notes on the Vegetation of Norfolk Island: Narrative of a visit to the Australian Colonies, 1843, pp. 251–273.

A small but interesting Flora, having a closer affinity to the New Zealand than the Australian. Myrtaceæ and Proteaceæ are apparently unrepresented. *Araucaria excelsa*, the Norfolk Island Pine, is the most conspicuous feature in the vegetation, towering high above all other trees. Allied species occur in New Caledonia and New South Wales.

CATO, Tregosse, Coringa, Madeleine Cays, and Willis group are islets off the east coast of Australia, concerning which nothing is known botanically.

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12. POLYNESIA.

FIJI ISLANDS.—An Archipelago of some 255 islands, lying between 15° and 22° S. lat., and 175° E. and 177° W. long., and having an area of about 7,403 square miles. In the larger island the mountain peaks rise to a height of 4,000 feet.

The principal islands are:—

Viti Levu	-	4,112	sq. miles.	Bega	-	13	sq. miles.
Vanua Levu	-	2,432½	,,	Yedua	-	13½	,,
Taviuni	-	217¾	,,	Lakemba	-	12	,,
Kadavu	-	124½	,,	Matuka	-	11	,,
Windward	-	59	,,	Totorja	-	11	,,
Koro	-	57¾	,,	Maugo	-	10	,,
Angau	-	46	,,	Chichia	-	10	,,
Ovalau	-	42½	,,	Laucala	-	9	,,
Rabi	-	28	,,	Vea	-	9	,,
Moala	-	28	,,	Naitaba	-	9	,,
Quamea	-	26	,,	Kanacia	-	8	,,
Loma-Loma	-	24	,,	Mokani	-	4¾	,,
Vatu Lele	-	18½	,,	Batiki	-	4	,,
Ono	-	13	,,				

On account of the system of cultivation followed by the natives of constantly selecting new spots as the old become exhausted, and other evidence, Seemann was of opinion that there was very little genuine virgin forest even at the date of his visit. Nevertheless, the islands support a luxuriant vegetation, rich in endemic species, but with few endemic genera. In general character the flora is Malayan, with a slight intermixture of Australian types.

Seemann, B. Flora Vitiensis. London, 1865–1873. 4to. pp. 453, with one hundred coloured plates.

Seemann, B. Viti: An account of a Government Mission to the Vitian or Fijian Islands in the years 1860–1861. Cambridge, 1862. 8vo. pp. 447, with illustrations and a map.

Baker, J. G. Ferns of the Fiji Islands: Journal of Botany, 1879, pp. 292–300.

Horne, J. A Year in Fiji, or an Inquiry into the Botanical, Agricultural, and Economical Resources of the Colony. London, 1881. 8vo. pp. 297, with a map.

Baker, J. G. Recent Additions to our Knowledge of the Flora of Fiji: Journal of the Linnean Society, xx. (1883), pp. 358–373.

FANNING ISLAND.—A small coral island, in about 159° W. long. and 4° N. lat. Vegetation restricted to the universal Polynesian sea-shore plants.

Hemsley, W. B. List of Plants collected in the Pacific Islands, by J. T. Arundel: Botany of the "Challenger" Expedition, i., part 3 (1885), p. 116.

There are fifteen flowering plants in the collection in question in the Kew Herbarium.

MALDON ISLAND.—A small coral island, in 155° W. long. and 4° S. lat., with a scanty vegetation, consisting of some of the same species inhabiting Fanning and Pitcairn.

Hemsley, W. B. Plants collected in Maldon Island, by James Macræ: Botany of the "Challenger" Expedition, i. (1885), Introduction, p. 17.

STARBUCK.—A small island to the south of Maldon, in about 156° W. long. and 5° S. lat.

The common Polynesian *Lepidium piscidium* and *Sida fallax* are the only plants at Kew from this island.

CAROLINE ISLAND.—A small coral island in mid Pacific, in 150° W. long. and 10° S. lat. It was the station of one of the United States expeditions for the observation of the transit of Venus.

Trelease. Plants collected in Caroline Island, by Dr. Dixon: Memoirs of the National [American] Academy of Sciences, ii., 1884, p. 88.

Hemsley, W. B. List of Plants collected in Caroline Island: Botany of the "Challenger" Expedition, i. (1885), Introduction, p. 18. Reproduced from the foregoing.

About twenty species of flowering plants, of all them widely spread in Polynesia, and some having a much wider range.

PITCAIRN ISLAND.—The refuge of the mutineers of the "Bounty," and the home of their descendants, is under the supervision of the Governor of New South Wales. It is situated in about 130° W. long. and 25° S. lat. There is no complete account of the vegetation in existence.

Hemsley, W. B. A list of Plants in the Kew Herbarium from Pitcairn Island: Botany of the "Challenger" Expedition, i. (1885), Introduction, p. 18.

About a dozen species are known, including the widely-spread *Hibiscus tiliaceus*, *Osteomeles anthyllidifolia*, *Metrosideros polymorpha*, *Morinda citrifolia*, *Guettarda speciosa*, and *Cerbera Odollam*.

It is announced that the British Government has annexed the Suwarrow Islands in 13° 21′ S. lat. and 163° 20′ W. long.; Rotumah Islands, north of the Fijis, in about 12° 50′ S. lat. and 177° E. long.; Penrhyn Island, in 9° 50′ S. lat. and 158° 30′ W. long.; and Christmas Island, in 2° N. lat. and 158° W. long. Palmerston

Island, in 18° S. lat. and 163° W. long., is reported to be inhabited by a small English-speaking community.

A protectorate has also been proclaimed over the Cook Islands, which are situated between the Navigator's Islands to the west, and the Society Islands to the east. Rarotonga is the largest, and rises to a height of 2,000 feet. The following plants in the Kew Herbarium were collected in Rarotonga by the Rev. W. Wyatt Gill :—*Elæocarpus* sp., *Alphitonia excelsa*, *Inocarpus edulis*, *Melastoma denticulatum*, *Mussænda frondosa*, *Vitex trifolia*, *Ficus tinctoria*, and *Centotheca lappacea*. The same gentleman also collected a few plants in the neighbouring island of Mangaia, including the widely spread *Osteomeles anthyllidifolia*.

Many other islands in the Pacific Ocean, mostly uninhabited, are English possessions, and some of them have been leased out for guano collection. Among these are Pilgrim, Ducie, Roggewein, Dudosa, Vostoc, Bauman, and Flint.

Hemsley, W. B. List of Plants collected by J. F. Arundel, Esq., in various small guano islands in the Pacific. Botany of the "Challenger" Expedition, i. 3, p. 116. See also Introduction to the same work, pp. 13–19.

13. THE DOMINION OF CANADA AND NEWFOUNDLAND.

The Dominion of Canada extends from the Atlantic to the Pacific, through nearly 86 degrees of longitude, from 55° to 141° W., and from 42° N. lat., in the lake region, northward: the area being estimated at 3,470,392 square miles, exclusive of the great lakes and rivers. It is now divided into seven provinces, namely: Nova Scotia, Prince Edward Island, New Brunswick, Old Canada (Ontario and Quebec), Manitoba, British Columbia (which includes Queen Charlotte and Vancouver Islands), and the North-west Territories — Assiniboia, Saskatchewan, Alberta, and Athabasca.

There is no complete descriptive work on the vegetation of British North America; but Professor Macoun's "Catalogue," which is approaching completion, gives particulars of the distribution of the plants throughout the Dominion and Newfoundland, and descriptions of nearly all of them will be found in the works cited below.

Anticosti is an island in the Gulf of St. Lawrence, 125 miles long, and 30 miles across in its broadest part, with an estimated area of 2,500 square miles. Well wooded and mountainous.

British Columbia comprises the territory between the Rocky Mountains and the Pacific coast, the average breadth being about 250 miles, and the length of the coast line 450 miles. It is the most mountainous part of the Dominion, culminating in Mount Hooker, in the Rocky Mountains, which is about 16,600 feet high.

New Brunswick is situated between 45° 5′ and 48° 5′ N. lat., and is connected with Nova Scotia by a low isthmus. Area about 27,105 square miles.

Newfoundland is an island situated between 46° 37′ and 51° 39′ N. lat., and 52° 35′ and 59° 25′ W. long., with an estimated area of 40,200 square miles.

Nova Scotia is a peninsula at the eastern extremity of the Dominion, is about 300 miles long and 100 miles in its greatest breadth, with an area of 20,907 square miles, one-fifth of which consists of lakes, rivers, and inlets of the sea. Cape Breton Island forms a part of this province.

Prince Edward Island lies in a bay formed by Nova Scotia and New Brunswick, and is about 140 miles long by 34 miles in its greatest breadth, with an area of 2,156 square miles.

Vancouver Island lies on the Pacific side of the continent, between 48° 20′ and 50° 55′ N. lat., and 123° 10′ to 128° 20′ W. long., and has an area of 75,634 square miles.

Meyer, E. De Plantis Labradoricis, libri tres. Leipsic, 1830. 12mo. pp. 218.

Hooker, W. J. Flora Boreali-Americana; or the Botany of the northern parts of British America. London, 1833–1840. 2 vols. 4to. with 238 plates.

Torrey, J., and **Gray, A.** A Flora of North America. New York, 1838–1843. Ranunculaceæ to the end of Compositæ.

Provancher, L. Flore Canadienne, ou Description de toutes les Plantes des Forêts, Champs, Jardins et Eaux du Canada. Quebec, 1862. 8vo. pp. xxix et 842.

Lawson, G. Synopsis of Canadian Ferns. Montreal, 1864. 8vo.

Lyall, David. Account of Botanical Collections made on the North American Boundary Commission: Journal of the Linnean Society, vii., 1864, pp. 124–144.

Macfie, M. Vancouver Island and British Columbia. London, 1865. 8vo. pp. 574, illustrated.

Gray, A. Manual of the Botany of the Northern United States. New York, 1867, fifth edition.

Reeks, H. Flowering Plants and Ferns of Newfoundland. Newbury, 1871. 8vo.

Curtiss, Allen H. Catalogue of the Phœnogamous and Vascular Cryptogamous Plants of Canada and North-east United States. Liberty, Bedford, Va., 1873. 4to. pp. 8.

Emerson, G. B. A Report on the Trees and Shrubs growing naturally in the Forests of Massachusetts. Boston, 1875. Two vols. 8vo, illustrated.

Lindsay, A. W. H. Catalogue of the Flora of Nova Scotia, arranged according to Gray's Manual of Botany for the Northern United States, with an Introduction by J. Sommers: Proceedings and Transactions of the Nova Scotian Institute of Natural Science, iv. (1875–76), pp. 181–222.

Macoun, J. Report on the Botany of the country from Vancouver Island to Carleton on the Saskatchewan: Geological Survey of Canada, 1875–76, pp. 110–232. A tabular view of the distribution of Canadian plants is given, pp. 230–232.

How, H. Additions to the List of Nova Scotian Plants: Transactions of the Nova Scotian Institute of Natural Science, iv. (1876–77), pp. 312–421.

Macoun, J. Synopsis of the Flora of the Valley of the St. Lawrence. Montreal, 1877. 8vo.

Fowler, Rev. J. Catalogue of New Brunswick Plants, 1878–79.

Eaton, D. C. Ferns of the United States and the British North American Possessions. Salem, 1878–80. Two vols. 4to, 81 coloured plates and descriptive text.

Bell, Robert. Canadian Forests: Geological Survey of Canada, 1879–80.

Macoun, J. Catalogue of Canadian Plants. Montreal. Vol. i., 1883–1886, Dicotyledons. 8vo. pp. 623. Mainly geographical.

Macoun, J. List of Plants collected by Dr. Robert Bell in Newfoundland: Geological and Natural History Survey of Canada, n. s. i., 1885, pp. 21–25 DD. 102 vascular plants.

Small, H. B. Canadian Forests. Montreal, 1885. 8vo. pp. 64.

Sargent, C. S. Report on the Forests of North America, exclusive of Mexico: Department of the Interior Census Office [U.S.A.], tenth census, 1880. Washington, 1884. 4to. pp. 612, with numerous maps, besides a separate volume containing sixteen large folio maps illustrating the distribution of the trees in British territory as well as in the United States.

Baldwin, H. The Orchids of New England. New York, 1884. 8vo. pp. 158, illustrated.

Gray, A. Synoptical Flora of North America. New York, 1884–1886. The Gamopetalæ.

Canadian Forests. Canadian Handbook, Indian and Colonial Exhibition, 1886, pp. 121–125.

Lugrin, C. H. New Brunswick: its Resources, &c., 1886, Forests, pp. 145–159.

14. THE BRITISH WEST INDIAN ISLANDS, BERMUDAS, BRITISH GUIANA, AND BRITISH HONDURAS.

Purdie, W. Journal of a Botanical Mission to the West Indies: Hooker's London Journal of Botany, iii., 1844, pp. 501–533; iv., 1845, pp. 14–27. Also reprint.

Grisebach, A. H. R. Flora of the British West Indian Islands. London, 1859–61. 8vo. pp. 789.

Grisebach, A. H. R. Die Geographische Verbreitung der Pflanzen Westindiens, 1865: Goettingen Abhandlungen, xii., 1866; Gesammelte Abhandlungen und kleinere Schriften zur Pflanzengeographie, pp. 222–285.

Daniell, W. F. On the Cascarilla Plants of the West India and Bahama Islands: Pharmaceutical Journal, iv., 1863, pp. 144–150, 226–231. Also reprint.

Fée, A. L. A. Histoire des Fougères et des Lycopodiacées des Antilles. Paris, 1866. 4to. pp. 164, tt. 34.

Johow, Fr. Die chlorophyllfreien Humusbewohner Westindiens: Pringsheim's Jahrbücher, xvi. (1885), pp. 415–449, tt. 16–18.

Hemsley, W. B. Botanical Bibliography of the Lesser Antilles . . . . Tobago to Porto Rico, inclusive. Appendix to the Report of the British Association Committee, consisting of Mr. W. T. Thiselton Dyer (Secretary), Prof. Newton, Prof. Flower, Mr. Carruthers, and Mr. Sclater, appointed for the purpose of . . . . . . taking steps to investigate the Fauna and Flora of the West Indies, 1888.

Anguilla.—About 60 miles north-west of St. Christopher, the Dutch island of St. Eustatius, the French island of St. Bartholomew, and the French and Dutch St. Martin lying between. It has an area of 35 square miles, and very little elevation. The adjacent Dog and Sombrero Islands belong to Anguilla. Owing to great droughts and the absence of freshwater springs, this island is not very fertile, yet a considerable amount of garden produce is raised and finds a ready market in St. Thomas.

Antigua.—In 17° 5′ N. lat. and 61° 50′ W. long., and about 70 miles in circumference. The mountains reach a height of 2,200 feet, but the vegetation is not so luxuriant as in most of the neighbouring islands, on account of the comparatively small rainfall. Five Islands are on the western side.

Hooper, E. D. M. Report upon Antigua in Relation to Forestry. Colonial Office, 1888.

Bahamas, Turks, and Caicos Islands.—Though separated politically, these islands form one chain, extending from 71° to 79° W. long., and from about 21° to 27° 30′ N. lat. The principal islands of the Bahamas proper are: New Providence, Abaco, Harbour, Eleuthera, Inagua, Mayaguana, Andros, Great Bahama, Ragged Island, Rum Cay, Exuma, Long Island, Crooked and Acklin Islands, Long Cay, Cat Island, Watling's Island (once known as St. Salvador), the Berry Islands, and the Biminis. Besides these there is an immense number of islets and rocks, and the total area is estimated at 4,466 square miles.

The names of the principal Turks and Caicos Islands, forming the South-eastern part of the chain, are: West Caicos, Providenciales, N. Caicos, Grand Caicos, E. Caicos, S. Caicos, Grand Turk and Salt Cay.

The principal named islands of this chain are:—

Abaco.
Andros.
Atwood Cay.
Bacon Cay.
Berry Island.
Bimini.
Castle.
Cat Cay.
Cat.
Cay Verde.
Chub Cay.
Columbus Cay.
Conception.
Crooked Island.
Duck Cays.
Dunmore.
East Caicos.
East Harbour.
Egg Island.
Eleuthera.
Exuma Chain.
Fish Cays.
Flamingo Cay.
Fortune Island.
Grand Caicos.
Great Bahama.
Great Exuma.
Great Stirrup Cay.
Green Cay.
Gun Cay.
Harbourd.
Highborn Cay.
Hog Island.
Hogsty Reef.
Inagua, Great.
Inagua, Little.
Isaac.
Jamaica Cay.
Jumentos Cays.
Little Exuma.
Little San Salvador.
Long Island.
Mayaguara.
New Providence.
North Caicos.
Plana Cay.
Providenciales.
Ragged Island.
Royal Island.
Rum Cay.
Salt Cay.
Samana.
San Salvador.
Scrub Cay.
Seal Cay.
Turks Island.
Water Cay.
Watling.
Wax Cay.
West Caicos.
White Cay.
Yuma.

Eggers, H. F. A. Flora of the Bahamas: Nature, xxxvii. (1886), p. 565.

Baron Eggers's paper is merely a sketch of the prominent features in the vegetation. Mr. J. G. Baker has since examined and reported on Baron Eggers's botanical collections: see report of the committee appointed for the purpose of exploring the Flora of the Bahamas in the Report of the British Association for 1888.

Barbados.—This island lies in about 13° 10′ N. lat. and 59° 30′ W. long., and is the most easterly of the West Indian islands. It is nearly twenty-one miles long by fourteen in breadth, and has an area of 166 square miles. The greatest elevation is 1,150 feet, and the eastern side is very rugged.

Hughes, Griffith. The Natural History of the Barbados. In ten books. London, 1750. Folio. pp. 314, tt. 29. Botany, pp. 97–256.

Maycock, J. D. Flora Barbadensis. London, 1830. 8vo, with a geological map.

Schomburgk, R. History of Barbados. London, 1848. 8vo. (Flora, pp. 573–633.)

Barbuda.—A small uninhabited island, about half a degree north of Antigua, in about 17° 40′ N. lat.

Caicos Islands. *See* **Bahamas.**

DOMINICA.—This island lies between the French islands of Guadeloupe to the north-west and Martinique to the south-east, in 15° 20′ N. lat. and 61° W. long. It is twenty-nine miles long by sixteen broad, with an area of 292 square miles, and the mountains rise to an altitude of nearly 5,000 feet. The vegetation is luxuriant, and the forests contain valuable timber.

Johow, F. Vegetationsbilder aus West-Indien: eine Excursion nach dem kochenden See auf Dominica: Kosmos, 1884, ii., pp. 112–130, 270–285. Abstract in Engler's Jahrbücher, vii. (1886), Literaturbericht, p. 76.

Nicholls, H. A. A. The Natural Resources of Dominica: Handbook of the West Indies and British Honduras, Colonial and Indian Exhibition, 1886, pp. 120–126.

Mr. Ramage has botanised Dominica and St. Lucia for a joint Committee appointed by the Royal Society and British Association, and his collections are being determined at Kew.

GRENADA.—Between 11° 58′ and 12° 30′ N. lat., and in about 61° 40′ W. long., and about twenty-one miles long by twelve miles in its greatest breadth, with an area of 125 square miles. The Grand Etang, a lake on the summit of the mountain ridge, at an elevation of 1,740 feet, is one of the most remarkable natural features.

Murray, G. A Half-holiday in Grenada: Gardener's Chronicle, series 3, iii., pp. 8.

GRENADINES.—A group of small islands lying between Grenada and St. Vincent, partly attached to the Government of Grenada and partly to that of St. Vincent. The largest are Bequia and Carriacou, and the other named ones are Ronde, The Sisters, Les Tantes, Savan, Hillsborough, Frigate, Union, Little Martinique, Bird, Mayero, Cannouan, Little Cannouan, Sail, Quatre, Moustique, and Baliceaux.

JAMAICA.—The most westerly and the largest of the British West Indian islands, lying west of Hayti or St. Domingo, and south of Cuba, between 76° and 78° 31′ W. long., and 17° 40′ and 18° 30′ N. lat. It is 144 miles long and 50 in extreme breadth, with an area of 4,193 square miles, and the mountains range from 5,000 to 6,000 feet high, with here and there loftier peaks up to 7,500 feet.

The Cayman Islands are a dependency of Jamaica. They lie to the north-west, between 19° 10′ and 19° 45′ N. lat., and 79° 30′ and 80° 35′ W. long. Grand Cayman, the largest of these islands, contains about 2,000 inhabitants. Little Cayman and Cayman Brac are also inhabited.

Pedro and Morant Cays to the south of Jamaica, in about 17° N. lat., are merely guano islands. Altogether these dependencies have an area of about 90 square miles.

Sloane, Hans. A Voyage to the islands Madera, Barbados, Nieves, St. Christopher, and Jamaica, with the Natural History . . . . of the last of those islands. London, 1707–25. Two vols. folio, with 274 plates.

Browne, P. The Civil and Natural History of Jamaica. London, 1756. Folio. pp. 503, tt. 50. Botany, pp. 71–374, tt. 1–38.

Jenman, G. S. Hand list of Jamaica Ferns. Demerara, 1881. Small 8vo. pp. 65.

The Flora of Jamaica has been almost fully investigated. The Cayman Islands have recently been botanically explored by Mr. W. Fawcett, F.L.S., Director of the Botanical Department, Jamaica, though the results have not yet been published. His collection of dried plants, determined at Kew, consists of about 100 species, and they are almost without exception quite common species.

Leeward Islands.—The most northerly group of the Lesser Antilles, of which the following are British: Sombrero, Antigua, Montserrat, St. Kitts, Nevis, Dominica, and the Virgin Islands.

Montserrat.—Situated in 16° 45′ N. lat. and 62° 10′ W. long., and having an area of 35 square miles. It is very mountainous, the highest peak slightly exceeding 3,000 feet, and several of them reaching 2,500 feet. These mountains are said to be covered to their summits with virgin forest.

Nevis.—This island lies to the south-east of St. Christopher, from which it is about two miles distant. Its area is about 50 square miles, and its greatest elevation 3,200 feet.

Sloane visited this island, but he made no collections there.

St. Christopher or St. Kitts.—This island lies to the north-west of Antigua, in 17° 20′ N. lat. and 62° 45′ W. long., and has an area of sixty-eight square miles. Mount Misery, the highest peak, has an altitude of 4,060 feet. "The higher slopes of the mountains are clothed with grass, while their summits are crowned with noyeau or iron wood, Spanish ash, red sweetwood, wild mahoe, snakewood, white box, dogwood, and other forest trees." Handbook of the West Indies and British Honduras, Colonial and Indian Exhibition, 1886.

Robinson, H. G. R. Vegetation of St. Kitts: Hookers' Kew Journal of Botany, ix., 1857, pp. 115–119.

St. Vincent.—Situated in about 13° 10′ N. lat. and 60° 57′ W. long., and about eighteen miles long by eleven broad, with an area of 140 square miles. The extinct volcano, called the Souffrière, rises to a height of 3,700 feet, and the Morne à Garou to 4,000 feet. Vegetation luxuriant, and perhaps more diversified than in any of the chain of islands from Tobago to Antigua, except Dominica.

Guilding, Lansdown. An Account of the Botanic Garden in the Island of St. Vincent. Glasgow, 1825. 4to. pp. 47, with three coloured views and plan of the garden.

Hooper, E. D. M. Report on the Forests of St. Vincent. London, 1886. Folio. pp. 13.

St. Lucia.—One of the most picturesque of the Windward Islands, lying south of the French island Martinique, in 14° N. lat. and 61° W. long. It is forty-two miles long and twenty-one in its greatest breadth, with an area of 243 square miles. The greatest altitude is about 3,300 feet, and here, as in St. Vincent, there is a Souffrière, or sulphur mountain. Maria, Gros, and Pigeon are adjacent islets. See note under Dominica.

Tobago.—Situated in 11° 9′ N. lat. and 60° 40′ W. long., and about twenty-three miles north-east of Trinidad. Twenty-six miles long by seven and a half broad, with an area of 114 square miles, and a maximum elevation of 1,800 feet. The virgin forests of the central mountain ridge are reported to be intact. A small collection of dried plants made by Mr. Meyer, contained several undescribed species.

Meyer, G. L. A Botanist's Home in Tobago. Gardener's Chronicle, n. s. xiv. (1880), p. 456. A fragment.

TRINIDAD.—This island is opposite the delta of the Orinoco, Venezuela and may be regarded as a detached piece of the mainland. It lies between 10° and 11° N. lat., and 61° and 62° W. long., and has an area of 1,754 square miles. The surface is undulated and hilly in parts, though the greatest elevation does not exceed 3,000 feet.

Crueger, H. Outline of Flora of Trinidad. London, 1858. 8vo. pp. 27.

Eaton, D. C. Fendler's Ferns of Trinidad: Coulter's Botanical Gazette, November 1878. A list of 114 species.

Devenish, S. Vernacular and Botanical Names of the Woods of Trinidad: Handbook of the West Indies and British Honduras, Indian and Colonial Exhibition, 1886, pp. 29–33.

Jenman, G. S. The Ferns of Trinidad: Journal of Botany, 1887, pp. 97–101.

TURKS ISLAND. *See* Bahamas.

VIRGIN ISLANDS.—An archipelago to the east of Portorico, the principal British islands being Virgin Gorda, Anegada, Jost Van Dyke, Tortola, Bieque, and Peter's Island; but altogether there are thirty-two islands besides "rocklets."

Tortola is in about 18° 25′ N. lat. and 64° 40′ W. long., and has an area of twenty-six square miles. It is everywhere hilly, with a maximum elevation of 1,600 feet.

Virgin Gorda lies a little to the north-east of Tortola, and is only ten square miles in area. It is hilly and barren in the eastern part.

Anegada is the most northerly of the group, and is a low coral island, with an area of fourteen square miles.

Eggers, H. F. A. The Flora of St. Croix and the Virgin Island. Washington, 1879. Bulletin of the United States National Museum, No. 13. 8vo. pp. 133.

WINDWARD ISLANDS.—The southern group of the Lesser Antilles, namely, St. Lucia, St. Vincent, Barbados, the Grenadines, Grenada, and Tobago.

BERMUDAS.—A chain of islands, twenty-five miles long, in the Atlantic Ocean, in 32° N. lat. and 64° W. long., and between 600 and 700 miles, from Cape Hatteras, North Carolina. They are of calcareous limestone, and nowhere more than 250 feet above the level of the sea. The main island, Bermuda, on which the town of Hamilton is situated, is about 9,000 acres in extent. Ireland, Boaz, Somerset, Tucker, Elizabeth, Goat, Castle, Nonsuch, Coopers, St. Davids, St. Georges, Coney, and Ferry Islands are all relatively small, and some of them little more than rocks.

Hemsley, W. B. Botany of the "Challenger" Expedition, i., part 1, (1885), pp. 1–128, tt. 1–13, and "Introduction" to the same work, pp. 46–49.

Lefroy, J. H. The Botany of Bermuda. Washington, 1885. Bulletin of the United States National Museum, No. 25. 8vo. pp. 141.

Reade, C. A. Plants of the Bermudas or Somer's Islands. Hamilton, Bermuda, 1885. 8vo. pp. 112 and index. Descriptions in English of the Indigenous and Naturalized Plants.

The probably indigenous vascular plants number 144, belonging to 109 genera and 50 natural orders. Eight species are apparently endemic, but they are all closely allied either to North American or West Indian forms. A "Cedar" (*Juniperus bermudiana*) and a Palm (*Sabal Blackburniana*) are the only indigenous trees; the former constituting much of the wealth of the islands.

BRITISH GUIANA.—An irregular tract of north-eastern South America, extending from about 56° 21′ to 61° 50′ W. long., and from 1° to 8° 30′ N. lat., with an estimated area of 109,000 square miles. It includes the settlements of Demerara, Essequebo, and Berbice.

Aublet, F. Histoire des Plantes de la Guiane Française. London, 1775. 4to, two vols. letterpress, and 392 plates.

Schomburgk, R. Versuch einer Fauna und Flora von Britisch Guiana. Leipzig, 1848. 8vo. Flora, vol. iii. (Reisen), pp. 787–1,212.

im Thurn, E. F. Among the Indians of Guiana. London, 1883. 8vo. pp. 445, illustrated.

im Thurn, E. F. Palms of British Guiana: Timehri, iii. (1884), pp. 219–276. Also Reprint.

Oliver, D., and **im Thurn, E. F.** The Botany of the Roraima Expedition of 1884: Transactions of the Linnean Society, 2 series, Botany, ii., pp. 249–300, tt. 37–56. The descriptions repeated in Timehri, v., 1886, pp. 145–223.

Jenman, G. S. The Primeval Forests of British Guiana: Gardener's Chronicle, 3 series, i. (1887), pp. 541–543, 573–575, 637–639.

BRITISH HONDURAS.—A portion of eastern Central America, bounded to the north by Yucatan, to the west and south by Guatemala, and situated between 15° 54′ and 18° 30′ N. lat., and 88° 10′ and 89° 10′ W. long., with an estimated area, including the adjacent Cays, of 7,562 square miles. Turnesse is the largest of the numerous islands off the coast.

Hemsley, W. B. Botany of the Biologia Centrali-Americana. London, 1879–88. 4to. 5 vols., with 110 plates.

> Includes British Honduras, though almost nothing was known of the botany up to that date. One of the most remarkable features in the vegetation are the pine groves down to the sea level.

Morris, D. Colony of British Honduras. London, 1883. 8vo. pp. 152, with a map.

Woods, Fibres, etc. of British Honduras. Handbook of the West Indies and British Honduras, Indian and Colonial Exhibition, 1886, pp. 158–168.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 32.] **AUGUST.** **[1889.**

THE FLUTED SCALE-INSECT.

(*Icerya Purchasi*, Maskell.)

WITH PLATE.

An insect which ranks amongst one of the most destructive pests injurious to plants has made its appearance of late years in South Africa, New Zealand, and California. It belongs to the family Coccidæ or scale insects, and is known under various popular names. In South Africa it is called "the Australian Bug"; in New Zealand, the "Cottony Cushion-scale"; and in California it is indifferently the "White scale," "Ribbed scale," or "Cottony Cushion-scale." Professor Riley, who has thoroughly investigated its life-history, suggests that the insect be known as the "Fluted scale." Mr. Maskell first described the species from New Zealand specimens, in 1878 (New Zealand Trans., Vol. XI., 1878, p. 221), and whatever diversity may exist as regards its popular name, it is now known to science as *Icerya Purchasi*, Maskell.

It was first observed in South Africa at Cape Town in 1873. In 1876 it had spread to the neighbouring division of Stellenbosch, and is

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now more or less prevalent throughout the Colony. Mr. Roland Trimen, F.R.S., states that (in 1887) "the orange industry of the western districts " (of Cape Colony) has suffered most severely; scarce, very inferior, and " exceedingly dear fruit being now only obtainable where it used to be " abundant, good, and cheap." He further remarks, "the 'bug' has " spread to Natal within the last few years, and last year I received " specimens from there found on the common Wattle (Acacia). " Only yesterday (7th February 1887) I was sorry to receive a lot " found there on the orange."

In New Zealand *Icerya Purchasi* is described as "having destroyed " whole orchards of orange trees in Auckland; and in Nelson and " Hawke's Bay it is a dreaded pest on all kinds of plants."

Indeed, Mr. Maskell states that it "is so voracious and universal a " feeder, so repulsive in its aspect, and so destructive in its effects that, " in spite of kerosene mixtures which undoubtedly destroy it, the most " drastic remedy is the best. Anyone, therefore having a tree, especially an ornamental or a fruit tree, attacked by *Icerya Purchasi*, is " strongly recommended to make no delay, but to cut down and burn " every stick of the tree as soon as possible."

Professor Riley received the first American specimens in 1872 from San Francisco, and he is of opinion that "all evidence points to its " introduction into California about 1868, and probably from Australia " on *Acacia latifolia*." It is now "a formidable pest, and has gained " such hold on the orange groves in California in spite of the most " strenuous efforts, that the people find it impossible to keep it down."

Before proceeding to give a general account of *Icerya Purchasi*, and the various steps that have been taken to deal with it, it may be well in the first place to quote Mr. Maskell's description as given in *An Account of the Insects noxious to Agriculture and Plants in New Zealand*, pp. 104–7:—

Genus: *Icerya*, Signoret.

Adult females having antennæ of 11 joints; covered with thin mealy secretion or with cotton; stationary; with or without ovisac. Rostrum and mentum present. Segmentation inconspicuous.

Adult males without tassels on the abdomen; antennæ with two dilations on each joint.

Two species only of this genus are at present known, the one described below and another, *I. sacchari*, infesting sugar-canes in Mauritius. The male of the latter is unknown. Possibly researches in Australia might result in the discovery of others.

Icerya Purchasi, Maskell.

(The "Cottony Cushion-scale.")

N.Z. Trans., vol. xi., 1878, p. 221; vol. xvi., 1883, p. 140; vol. xvii., 1884, p. 30; vol. xix., 1886, p. 45.

Adult female dark reddish-brown, covered with a thin powdery secretion of yellowish meal, and with slender glassy filaments; stationary at gestation, and gradually raising itself on its head, lifting the posterior extremity until nearly perpendicular, filling the space beneath it with thick white cotton, which gradually extends for some distance behind it in an elongated white ovisac, longitudinally corrugated; ovisac often much longer than the insect, and becoming filled with oval red eggs. Length of female about ⅕ in., reaching sometimes nearly ⅓ in. Body previous to gestation lying flat on the plant, the edge slightly turned up; on the dorsum a longitudinal raised ridge, forming one or more prominences. Insect covered all over with numerous minute fine hairs, most thickly on the thoracic region; round the edge these hairs are longer, and are arranged in tufts somewhat closely set; the tufts are black, and contain from 20 to 30 hairs in each. Amongst the hairs in the tufts are several protuding tubular spinnerets, having on the outer end a kind of multiglobular ring or crown; from these proceed cylindrical, glassy, straight tubes as long as the tufts of hair. Long, fine, glassy, delicate filaments, as long as the body of the insect, radiate from the edge all round; but these, being very fragile, are often irregular or absent. During gestation thick, short, cottony processes form at the edge of the thorax, seemingly attached to the feet. Antennæ of 11 joints, very slightly tapering; each joint bearing hairs. Feet normal, somewhat thick. Rostrum not long; mentum triarticulate. Procreation commencing soon after the first formation of the ovisac, the eggs being ejected into the sac as it grows; ovisac at completion containing sometimes as many as 350 eggs; ovisac convex above, sometimes irregularly split, more often nearly conical, divided by several regular longitudinal grooves or ribs.

Female of second stage dark-red, elongated, slightly convex, active, covered with thin meal, or short curly cotton. Body hairy with marginal tufts and spinnerets, as in adult. Anal tubercles inconspicuous, but the abdomen exhibits three small lobes on each side, from which spring six short setæ. Antennæ of nine nearly equal joints, hairy. Feet normal, thick. Several radiating, fine, cottony filaments. Length of insect variable, from $\frac{1}{10}$ in. to $\frac{1}{6}$ in. The dorsum exhibits the longitudinal raised ridge, but less conspicuously than in the adult.

Young larva, about $\frac{1}{24}$ in. long, dark-red, elongated, flattish, active; covered with yellow cottony down. Antennæ of six joints, hairy; the last joint is much the largest, clavate, apparently four-ringed, bearing four long hairs. Feet slender; digitules short, fine hairs. Eyes prominent, tubercular. Mentum biarticulate. Anal tubercles represented by three small processes at each side of the abdominal extremity, each process bearing a very long seta. Six longitudinal rows of circular multilocular spinnerets, four on the dorsum and one on each edge. Alternating with these are rows of hairs with tubercular bases.

Adult male large, the length slightly varying; some specimens reach $\frac{1}{8}$ in.; expanse of wings, $\frac{1}{4}$ in.; length of antennæ about $\frac{1}{8}$ in. Body red, with a shining, diamond-shaped, black patch on the dorsal surface of the thorax; legs and antennæ black. Wings dark brown with (in some lights) a bluish tinge, marked with oblique, narrow, wavy stripes; main nervure red, branching once; there are also two longitudinal, whitish, narrow bands.* Antennæ very long and slender, with 10 joints, which may easily be taken for 19, for, after the first, which is short, round, and simple, all the other nine have two dilated portions with a constriction in the middle, and on each dilation is a ring of very long hairs, giving the antenna a feathery appearance.† Eyes very large and prominent, almost pedunculated, brown, divided into numerous semi-globular facets. Feet long and very hairy; coxæ short and thick; tibiæ long and slender; claw thin; upper digitules absent; lower pair only short bristles. Abdomen slender, segments somewhat distinct; on

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* Signoret (Ann. de la Soc. Ent. de France, 1875), under the genus *Monophlebus*, speaks of "les plis hyalins" as existing also in the wings of the males of that genus.

† Misled by similar appearances, Burmeister and Westwood assign 25 joints to the male antenna of *Leachia fuscipennis*.

each segment some hairs; the last segment ends in two thick conspicuous cylindrical processes, which, on side view, are seen to incline upwards, and beneath them is the short, conical spike, sheathing the penis. Penis red, longish, tubular, and thick, with many recurved short hairs, and at the end a ring of short spines. Each of the two processes on the last segment bears three or four long setæ, but there do not appear to be any of the long cottony appendages seen in the males of most Coccids.

Habitat.—On wattle, pine, orange, lemon, cypress, rose, gorse, grass, and, in fact, on almost every kind of native and introduced plants, Nelson, Hawke's Bay, Auckland. It will probably appear also elsewhere, but the climate of Canterbury and Otago may prove too cold in winter for it.

Allied to *I. sacchari*, Guérin, which damages sugar-canes in Mauritius; but differing in the formation of the ovisac, the presence of the marginal tufts and spinneret tubes in the female, and in other particulars. The male of *I. sacchari* has not been described. The male of *I. Purchasi* is probably quite distinct.

This species is supposed to have come originally from Australia. It has been very injurious to orange and lemon trees at the Cape of Good Hope and in California. In Auckland it has destroyed whole orchards of the same trees, and in Nelson and Hawke's Bay it is a dreadful pest on all kinds of plants.

The following are references to the plate given on the opposite page:—

Icerya Purchasi.—*a*, insects on twig of Acacia (Wattle), natural size; *b*, adult female and ovisac, upper view; *c*, adult female and ovisac, side view; *d*, female of second stage; *e*, larva, with yellow cotton; *f*, adult male; *g*, haltere of male; *k*, two joints of male antenna; *m*, hairs, spinnerets, and glassy tubes of female; *n*, antenna of adult female.

The literature of *Icerya Purchasi* is already somewhat extensive.* The most complete and exhaustive account yet published is found in the report, for the year 1886, of Professor Riley, M.A., Ph.D., Entomologist to the U.S. Department of Agriculture, Washington, 1887, pp. 466–492.

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* *Report of the Commission appointed to inquire into . . . . the "Australian Bug."* Cape Colony, 1877.

Journal of Forestry. On the "Australian Bug" of South Africa. May 1882, pp. 41–46.

Insects injurious to Fruits. By William Saunders, F.R.S.C., Philadelphia, 1883 p. 400, with woodcut.

New Zealand Transactions. Vol. xi., 1878, p. 221; vol. xvi., 1883, p. 140; vol. xvii., 1884, p. 30; vol. xix., 1886, p. 45.

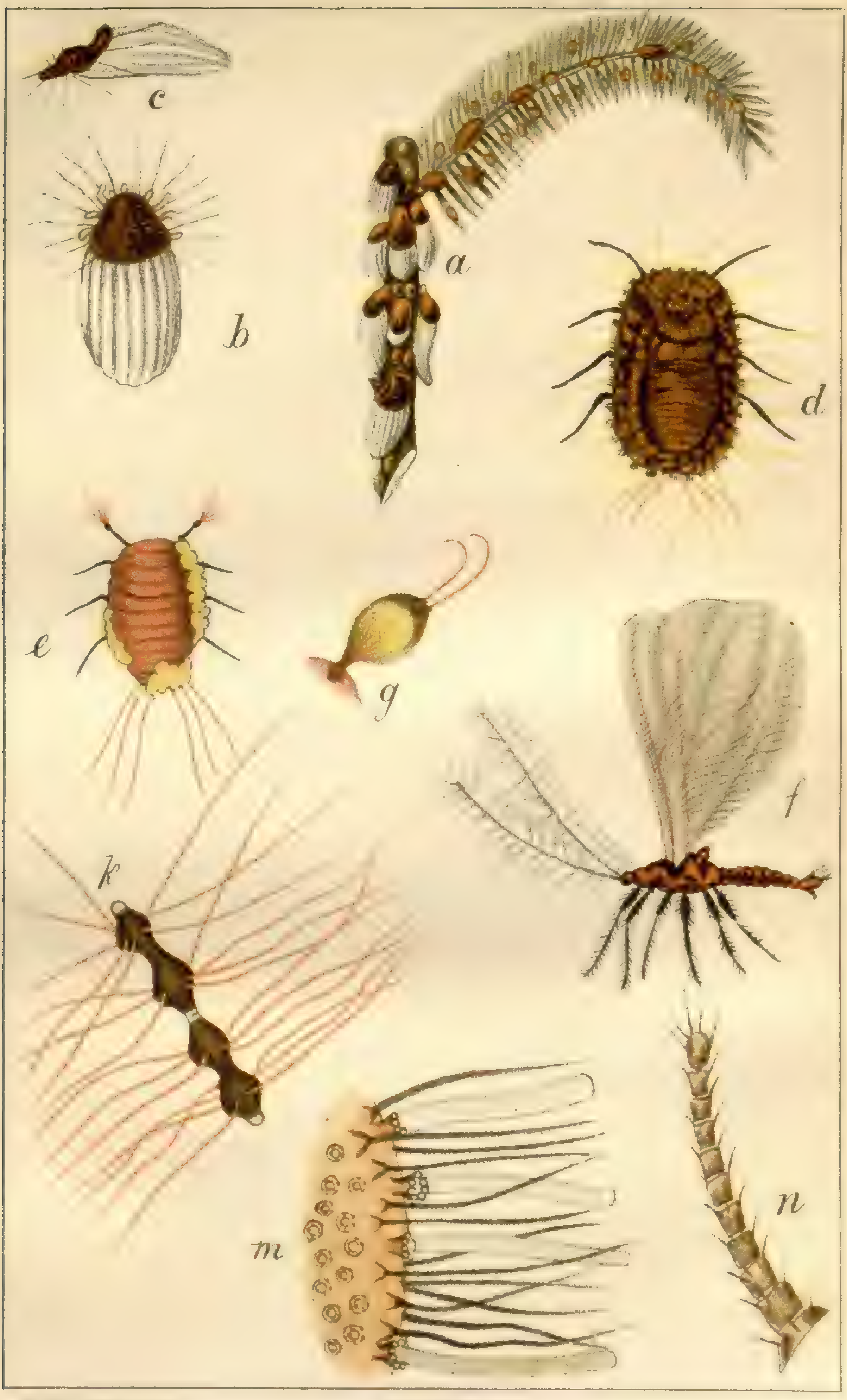
Report of the Entomologist, Charles V. Riley, M.A., Ph.D., for the year 1886 [U.S. Department of Agriculture], pp. 466–492, with plates. Washington, 1887.

The Icerya, or Fluted Scale. Bulletin 15, U.S. Department of Agriculture, Division of Entomology. Washington, 1887.

An Account of the Insects noxious to Agriculture and Plants in New Zealand. The Scale Insects (Coccidæ). By W. M. Maskell, F.R.M.S., Wellington, N.Z., 1887. pp. 104–107, plate xix.

Injurious Farm and Fruit Insects of South Africa. By Eleanor A. Ormerod, F.R.Met.Soc., and O. E. Jansen, F.E.S., London, 1889. pp. 69–98, with woodcuts. (The notes on *Icerya Purchasi* are a reprint, in abridged form, of a pamphlet published in 1887, under title of "Australian Bug of South Africa.")

[Further and more recent information respecting *Icerya Purchasi* is contained in *Insect Life*; a periodical Bulletin of the U.S. Department of Agriculture, Division of Entomology, vol. i., parts 1 to 20. July 1888 to June 1889.]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A.D. WILLIS, WANGANUI, N.Z.

PLATE XIX.

Icerya Purchasi, Maskell.

It would be impossible to curtail this report to any large extent, and as Professor Riley has specially investigated the subject with the view of successfully treating the insect from a horticultural point of view, it is desirable to place as much information as possible within reach of those who would not otherwise be able to obtain it.

The following is Professor Riley's account of *Icerya Purchasi* :—

We have, during the year, been conducting a special investigation of the habits of and remedies for the so-called Cottony Cushion-scale of California, an insect which for the last eight years has occupied much of the attention of the horticulturists of that State. We have been much interested in this pest since it was originally sent to us while in Missouri by Mr. R. H. Stretch from San Francisco in 1872, and have watched its increase and spread, until it became evident from its alarming prolificacy, from the great diversity of its food-plants, from its supposed immunity from the attacks of natural enemies, and from the protection against the action of insecticides afforded by its abundant waxy excretions, that especial study and experiment were much needed.

The following account of the insect is prepared from published accounts and unpublished correspondence; from our biologic notes made at the office in Washington, chiefly in 1878, 1880, and 1886; but more especially from our recent experience in the field (which the delay in publishing the report has enabled us to partly embody), and the observations of Messrs. Coquillett and Koebele, whose reports on experiments made to destroy it will be found given in full among the reports of agents.

GEOGRAPHICAL DISTRIBUTION.

So far as we have been able to learn, up to the date of present writing, the Cottony Cushion-scale is found only in California, in Australia, in South Africa, and in New Zealand. We shall discuss its introduction into California and its present limitations in that State in subsequent sections of this paper, and what we know of its spread in the other countries mentioned is here considered.

IN AUSTRALIA.—As will appear farther on, the evidence collected goes to prove that this insect is indigenous to Australia and has been exported from this colony to the two other colonies in which it occurs and to the United States. We have very few facts as to its occurrence in Australia and these are taken at second hand. We have addressed communications to a number of naturalists in different portions of that country, but their replies have at this writing not been received. From the "Report of the Commission appointed by his Excellency the " Governor to inquire into and report upon the means of exterminating " the insect of the family '*Coccidæ*,' commonly known as the 'Australian " Bug,'" published at Cape Town, 1877, and from the letter of Mr. Roland Trimen, dated February 5, 1877, and published by the Government Secretary of Cape Colony as "Government Notice No. 113, 1877," we find that at that time specimens of the insect were sent from Cape Town to different portions of Australia, and that replies were received as follows:—The Queensland authorities simply promised inquiry and report. The Government of South Australia did not recognise the insect in question as a native of that colony. The inquiry to Victoria was referred to Prof. Frederick McCoy, Director of the National Museum at Melbourne, who identified the insect as a new *Dorthesia*, "common in Victoria on different kinds of *Acacia*."

This is the extent of our information. Mr. Maskell, in his second paper on this species (Transactions and Proceedings New Zealand Institute, XIV., p. 226, 1881). writes: "When in Australia a few "months ago I observed at Ballarat an insect, certainly an *Icerya*, but "I think not *I. Purchasi;* but I had no opportunity of bringing away "a single specimen." There exists, then, a possibility at least that the insect under consideration is found at Ballarat as well as around Melbourne.

IN CAPE COLONY.—We find in the "Report of the Commission," &c., just cited, the following information on the spread of the insect in this colony :—

"From the answers received it would seem that the insect, having first appeared and succeeded in establishing itself in Cape Town and the vicinity, gradually spread along the lines of traffic by land and sea to different parts of the colony; and we may mention, in evidence of its irregular dispersal by chance methods of conveyance, that it was observed in the village of Ookiep, Namaqualand, only a few months after its first discovery in the Cape Town Botanical Gardens in 1873, and yet was not seen in the neighbouring division of Stellenbosch till the latter end of 1876."

The limits to which the insect had extended at the time of the publication of the report of the Commission (1877, presumably the latter part of the year) included the following localities:—Cape Town and neighbourhood, Simon's Town, Stellenbosch (Mulders Vlei), Malmesbury, Paarl, Wellington, Namaqualand (Ookiep), Bredasdorp, George (Brak River), Uitenhage, East London.

We have no information as to the present status of the insect in this colony, as the replies to our letters of inquiry have not yet come to hand.*

IN NEW ZEALAND.—From the paper containing Mr. Maskell's original description of *Icerya Purchasi* (Trans. and Proc. N.Z. Inst., XI., 220, 1878), we learn that the insect was first noticed at Auckland. A note by Mr. E. A. MacKechnie (Ibid., XIV., 519, 1881) indicated that it had greatly increased in presumably the same neighbourhood in 1881. In Mr. Maskell's second paper (Ibid., p. 226) he mentions in a footnote that he had just received the insect from Napier. In his third paper (Ibid., XVI., 140, 1883) he writes as follows :—

"*Icerya Purchasi* has spread greatly in the last two years. It had just reached Napier at the date of my last paper. It has now established itself in that district not only in gardens, but in the native forests. In Auckland it is attacking all sorts of plants. * * * It has reached Nelson, and I have had many communications from that place complaining of its ravages. * * * Whether this pest will spread in our colder southern climate (Christchurch) as it has in the warmer north remains to be seen. Our gardeners here are not in much dread of outdoor insects; they confine their attention to those in greenhouses. They may be right; still the winter even in Canterbury is not severe enough to kill these insects, and I know that in the Christchurch public gardens many trees have had to be burnt simply on account of the ravages of *Coccidæ*."

We have no information on this point from this colony later than 1883, but have taken steps to ascertain the present spread of the pest.

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* Just as the report is being sent to the printer we learn from Miss Ormerod that she has received specimens from Port Elizabeth, Cape Colony.

IMPORTATION OF THE SPECIES INTO CALIFORNIA.

The first printed record, with which we are acquainted, of the occurrence of the Cottony Cushion-scale in California is Mr. Stretch's article in the Proceedings of the California Academy of Sciences, Vol. IV., read September 16, 1872. In opening this paper he refers to the fact that "at a former meeting certain insects forwarded to this society "from Menlo Park, San Mateo County, by Mr. Gordon," were referred to him for examination. A careful search through the previous proceedings fails to show any mention of this previous sending, though at the meeting of July 1, 1872, Mr. John Hewston, junr., "exhibited "some limbs of Australian Acacia from San Mateo which were infested "by a species of Coccus, and stated that the insect had not only been "detected in its depredations upon said tree, but also upon the orange "trees." This latter reference may very possibly have been to the Cottony Cushion-scale, and if so it is interesting, as indicating already a spread of some miles from Menlo Park.

All the slight evidence possessed points to the introduction of this scale on Australian Acacia by Mr. George Gordon about 1868 or 1869. Mr. Stretch says:—

"This being all the information to be derived from the specimens referred to me, I visited Menlo Park in search of further information, and received a very hearty welcome from Mr. Gordon. The supposition is that the insect was imported from Australia some three years ago; at any rate it seemed to originate on the *Acacia latifolia*."

This was evidently Mr. Gordon's supposition, and the plain inference is that about three years previous to this time certain Acacias had been imported by Mr. Gordon from Australia as plants or cuttings contrary to the general custom, although it is not stated in so many words.

Dr. A. W. Saxe, of Santa Clara, Cal., in 1877, wrote*:—

"So far as I can ascertain, it was brought to California on some plants imported from Australia by the late George Gordon, of Menlo Park (the sugar refiner)."

In the introduction to our annual report as Entomologist to this Department for 1878 we referred to the serious complaints that came from the Pacific coast of injury by it to orchard and ornamental trees, and from specimens received from Dr. Saxe (Mr. Maskell's papers being unknown here then) referred it to the genus *Dorthesia*, and remarked:—

"It is an Australian insect, and has of late years been introduced on Australian plants into South Africa, where, as I learn from one of my correspondents, Mr. Roland Trimen, curator of the South African Museum, it has multiplied at a terrible rate, and become such a scourge as to attract the attention of the Government. It has evidently been introduced (probably on the Blue Gum or *Eucalyptus* (to California, either direct from Australia or from South Africa, and will doubtless become quite a scourge; because most introduced insects are brought over without the natural enemies which keep them in check in their native country and consequently multiply at a prodigious rate. It will be naturally partial to Australian trees, and shows a preference for Acacia, Eucalyptus, Orange, Rose, Privet, and Spiræa."

Professor Comstock, in the annual report of the Department of Agriculture for 1880, p. 348, cited this Article of Dr. Saxe's as the earliest article with which he was acquainted, and repeated Dr. Saxe's opinion as to the introduction of the insect.

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* *California Agriculturist and Artisan*, December 1877.

Beyond this we are able to get no information upon the subject, and these data are in all probability the first connected with the introduction of the Cottony Cushion-scale. There may possibly have been subsequent and independent importations, but that this is the one from which the main spread originated there can be little doubt.

Its Spread and present Limitation in California.

We are indebted to Mr. Matthew Cooke, of Sacramento, for communicating a lengthy and careful account of the localities in which the pest at present exists in California. Mr. Cooke has mapped out ten districts, six in the counties of Marin, San Mateo, Santa Clara, Sacramento, Sonoma, and Napa, in the San Francisco region, and four in the counties of Santa Barbara and Los Angeles, in the southern portion of the State.

The first infested district extends from Menlo Park to San Mateo, a distance of 10 miles. It is bounded on the east by the Southern Pacific Railroad, and extends some 3 miles west, including in consequence some 30 square miles. But little effort, according to Mr. Cooke, has been made to eradicate the pest in this district.

The second infested district is contained within the town limits of San Rafael, Marin County, about 14 miles north of San Francisco. In this district it has been held in check, but there are still some to be found, and its increase is only dependent upon a lapse of vigilance.

The third infested district includes the city of San José and the town of Santa Clara, and contains an area of about 16 square miles. In these towns the scale insects infested the ornamental and shade trees and shrubbery, but did not seem to trouble the deciduous fruit trees to any extent. At San José energetic measures have been taken; the trees have been cut back and their trunks scrubbed until the pest has been thoroughly eradicated. At Santa Clara, however, little has been done, and some places are seriously infested.

The fourth infested district occurs at the city of Sacramento, where only about 120 acres are infested, although it is stated to be rapidly spreading. The insect was first discovered in this district by Mr. Cooke in October 1885, in about eight gardens. The city trustees appropriated $200, and with this sum it was destroyed, except upon certain premises which the authorities could not enter. Mr. Cooke gives in this connection, as an instance of the rapidity of the multiplication and spread of the insect, the following:—

"In October 1885 a patch of these insects covering a space of about 3 by 4 inches was noticed upon a limb of an acacia tree. From these it spread, and in a little more than a year several orange and lemon trees and other plants growing closely in an area of about 160 by 80 feet had become seriously infested."

The fifth infested district is found at Healdsburg, Sonoma County, about 65 miles north by west of San Francisco. Here the insect is mainly comprised within the town limits, and infests the shade trees along the streets and the shrubbery in the gardens.

In Mr. Cooke's sixth district the insect cannot be said to exist at present. It comprises a single garden in the town of Saint Helena, Napa County, about 60 miles north by east of San Francisco. It was found upon a rose bush in that place by Mrs. Richard Wood in October 1882. The bush was destroyed, and the pest has not been found in that section since.

The seventh infested district includes the city of Los Angeles, where the insect is principally confined, according to Mr. Cooke, to the gardens and suburbs on the eastern side of the city. Mr. Coquillett says that as nearly as can be ascertained the insect was first introduced into Los Angeles in 1878 upon some nursery trees purchased from a San Francisco nurseryman. These trees were planted in a certain nursery, and when the insects were first noticed upon them the owner was requested to burn them. He neglected to do this and soon after failed in business, and the nursery fell into other hands. The new owner also proved indifferent, and from this point the insects spread into the surrounding orchards, going mainly in the direction of the prevailing winds. Some years ago a tree was found infested at Passadena, 7 miles east of Los Angeles, but it was immediately destroyed, and the insect has not been heard of since. At Pomona, 32 miles east of Los Angeles, the same thing happened in 1883. Two trees were found to be infested and were immediately destroyed, and the insect has not appeared since.

The eighth infested district is at Anaheim, Los Angeles County, 27 miles south by east of Los Angeles. Here the insect is purely local and does not seem to be spreading.

The ninth district is at San Gabriel, 9 miles east of Los Angeles. In the vicinity of this place are some of the largest orange groves in California. In 1880 or 1881, according to Mr. Cooke, a Mrs. McGregory bought a pot-plant in Los Angeles, brought it home, and placed it beside a small Orange near her house. In 1882 the neighbouring orange trees were found to be infested with the Cottony Cushion-scale. In the fall of 1883 it was found in some of the larger orchards so abundantly as to cause alarm among the growers. By means of a voluntary tax of five cents per tree, some fifteen hundred or two thousand dollars were raised and expended and the pest eradicated. The most radical measures were used. The trees were cut back to the crotches, the branches burned, and the trunks scrubbed. In 1885, however, the insect was again found, but only in a few trees.

The tenth and last district includes the orchards in and around the city of Santa Barbara. According to Mr. Coquillett the scale was introduced into this district in 1878. A number of trees from the same lot which first introduced the pest into Los Angeles was sent to Santa Barbara at about the same time. Mr. Cooke states that he visited this district in July 1884, and found Mr. Stowe's orchards (10 miles north of the city of Santa Barbara) the most seriously infested spot in the State. Forty acres, principally of lemon trees, were badly damaged, and over many acres the trees had been dug out and burned. Two miles north of Mr. Stowe's, Colonel Hollister's groves also contained the insect in numbers. About 40 acres were partially infested. The latter gentleman made strong endeavours to rid his groves of the insect, and spent a great deal of money, with only partial success. Mr. Cooke states that the course of the insect between Mr. Stowe's and Colonel Hollister's could be plainly traced over a rolling grazing land on the nettles, dock, and other weeds.*

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* Reports have gained currency that this Icerya was found abundantly around Santa Barbara on wild plants, and especially upon the "Grease-wood," and it has been argued from such reports that the species is indigenous. They have no foundation except in mistaken identity, a large Coccid belonging to the genus *Rhizococcus*, which occurs abundantly on *Artemisia californica*, having undoubtedly given rise to the report. The female of this species, which we shall describe as *Rhizococcus artemisiæ*, secretes a globular mass of white cottony wax, which is more or less distinctly ribbed, and her eggs are of the same color as those of the Icerya; but with these superficial resemblances which have misled, there are profound structural differences.

FOOD-PLANTS.

ORIGINAL FOOD-PLANT OF ICERYA PURCHASI.—There seems good reason to believe that this species is originally an Acacia insect, and that upon one or another of the plants of this genus it was imported from Australia into South Africa, California, and New Zealand. Australia is pre-eminently the home of the Acacias, while none are indigenous to California, nor, so far as we can ascertain, to New Zealand, and, as is well known, the species now found in these two countries have been introduced from Australia.

Professor McCoy, of Melbourne, in his original communication to the government of Cape Colony, in 1876, stated that the insect in question occurred in Victoria on "different kinds of Acacia."

Mr. J. C. Brown* states, on the basis of Mr. Trimen's description, that the "Australian Bug" appears to resemble in several details one of the Coccidae found on the Kangaroo Island Acacia, universally around Adelaide. This statement is so indefinite as to have little weight; yet there is more than a possibibilty that the Australian insect mentioned is the *Icerya.*

Mr. Trimen, in his report previously mentioned, states that the first specimens seen by him in Cape Colony occurred in 1870, at Clairmont, on Blackwood trees (*Acacia melanoxylon*), obtained from the botanic gardens at Cape Town. He goes on to say:—

"In the course of a few months the insect increased so prodigiously in number, and the Australian Acacias became laden with them to such an extent, that in the early part of 1874 the large Blackwood trees in the gardens, which were infested to a greater extent than any other plant, had to be cut down."

In New Zealand the first appearance of this insect was also upon an Australian Acacia Mr. Maskell, in originally describing the insect, in 1878, says: "My specimens of this subdivision were found on a hedge "of the Kangaroo Acacia,† in Auckland, in March last. I understood "from Mr. Cheeseman and Dr. Purchas, who kindly brought this insect "under my notice, that it had only lately appeared in Auckland, and "that it was only as yet to be found upon that one hedge."

In California the experience was almost precisely similar. Mr. Stretch, in his paper before the California Academy of Sciences, in 1872, stated that at Menlo Park "it seemed to originate upon *Acacia latifolia*, a "species imported from Australia." Miss Anna Rosecrans, writing to the *Pacific Rural Press* of February 17, 1877, says: "It was first "noticed at San Rafael on Acacia trees four or five years ago." Dr. Chapin, in the first report of the State Board of Horticultural Commissioners of California, 1882, says; "This scale has been, it is asserted, "known to be on the Acacia for seven years in San José, but it is only "during the past and present seasons that it has attracted attention" (presumably by its spread to other cultivated plants).

Thus we have much cumulative evidence that the species of the genus Acacia are the preferred food-plants of the Cottony Cushion-scale, and, admitting Australia as its proper home, they are probably its original food.

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* On the "Australian Bug" of South Africa. *Journal of Forestry*, May, 1882, VI., p. 44.

† *Acacia armata.*—C. V. R.

Its Food-plants in South Africa.—From Mr. Trimen's 1877 report we gather the following list of plants to which the Australian Bug had spread since 1873 :—

Acacia melanoxylon, Australian Acacias, " Golden Willow," *Casuarina*, *Pittosporum*, " Blue Gum " (rarely), Australian " Bottle-brush," Oak, Orange, Vine, Fig, *Laurustinus*, Rose, Rosemary, Strawberry, Verbena, Plumbago, Indian Jasmine, *Bougainvillea*, Hawthorn, *Poinsettia*, *Hakea*.

This list is not added to in the " Report of the Commission," &c., published at Cape Colony in 1877. Mr. Trimen, in the article cited above, gave the preference to the trees and shrubs of Australian origin; but Mr. J. C. Brown (*loc. cit.*) quotes him as writing, under date of March 17 (1882 ?), that the insect had then mainly attached itself to the orange trees. " Many of the finest plantations have been destroyed and " others are on the high road to destruction. You will remember," he says, " how good and cheap oranges used to be here; they have lately " been threepence and fourpence apiece, and often inferior in quality " even at such a price."

Its Food-plants in New Zealand.—From the various communications of Mr. Maskell and others in the Transactions and Proceedings of the New Zealand Institute we give the following list of plants which have been especially designated. There has been no attempt, however, on Mr. Maskell's part to give at all a complete list, and in fact, he says,* " In Auckland it is attacking *all sorts* of plants, from Apple and Rose " trees to Pines, Cypress, and Gorse." The plants affected are—

Common Furze, Orange, Lemon, *Acacia decurrens*, *Acacia armata*, Apple, Wattles, Rose, Gorse, Pine Cypress.

Its Food-plants in California.—Originally starting upon *Acacia latifolia* at Menlo Park, this insect soon spread to numberless other plants. Dr. Saxe in 1877 mentioned that it already attacked the Acacias, Australian Pea-vine, Rose, Honeysuckle, Ivy geranium, Laburnum, Pear, and the weeds in the orchard.

Dr. Chapin, in 1883, mentioned the following:

Pear, Apple, Bridal-wreath, Rose, Dwarf Box, Verbena, Veronica, *Acacia mollissima*, *Acacia latifolia*, *Acacia linnearis*, *Acacia floribunda*, *Pittosporum tobira*, Strawberry, Black Locust, California Laurel, Cork Elm, English Ivy, *Magnolia grandiflora*, White Oak, Dwarf Flowering Almond, Wild Grease-Wood.

Our recent experience in California, as well as that of Messrs. Coquillett and Koebele last summer, would indicate that, while there are few plants upon which the insect will not temporarily feed if it happen to fall upon them while in the first stage, yet the number of plants upon which it can thrive and multiply is limited. The larva will survive for weeks without food and will wander about in search of suitable food if it should find itself, for one cause or another, on that which is unsuitable. It undoubtedly thrives best on Acacias, and next to these we should place the Citrus fruits, the Quince, and the Pomegranate, and we doubt if it could thrive upon many other trees. The list of its food-plants, or rather of plants upon which it has been found, is longer than is justified, not only because of its power of endurance above noted, but because the young are easily carried by wind or otherwise to plants more or less uncongenial and on which they ultimately perish, while the adults are often dislodged from infested Acacia or Citrus trees on to plants under or near them.

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* Ibid., XVI., p. 140 (1883).

Among the more valuable trees upon which it certainly cannot thrive, and upon which it does not occur when they are grown at some distance from infested Acacia or Citrus trees, are the following: Pines, Cypress, Eucalyptus, Olive, Apricot, Peach, Pear, and Oleander.

The plants upon which Mr. Coquillett found females with egg-masses in limited numbers, and which were growing in situations so remote from any infested Acacia or Citrus trees as to preclude the idea that the adult insects had found their way to these plants from such trees, were as follows:—

Pomegranate, Quince, Apple, Peach, Apricot, Fig, Walnut, Locust, Willow, Pepper, Grape, Rose, Castor-bean, Spearmint, Rose-geranium.

Mr. Koebele, whose observations have been close and extensive, found that the Quince is always thickly infested, as is also the Pomegranate, while on Pear, Apple, Peach, and Apricot the scales were not numerous in the adult state. Only a few scales, and these nearly always small, were found upon the Castor-oil bean. Some Pecan trees were noticed on which some of the branches were completely covered with scales. A Willow hedge surrounded by plants which had been infested for over two years did not itself become attacked until the past summer. The Fig he states to be a favourite food-plant. On Eucalyptus he found young scales all summer, and in October he found twigs full of scales of all sizes. A few full-grown individuals were found upon a single Pepper tree (*Schinus molle*) growing in the orchard. The following is a supplementary list of plants upon which Mr. Koebele reported the scales most noticeable:—

Portulaca oleracea—scales often numerous, *Malva rotundifolia*, Grape (*Vitis* spp.)—scales occurring principally on petiole and leaf, *Medicago denticulata*, *Helianthus* spp., Rose (*Rosa* spp.)—scales growing often to an unusually large size, and very numerous on some varieties, *Epilobium coloratum*, *Erigeron canadensis*, *Bidens pilosa*, *Artemisia ludoviciana*, *Ambrosia psilostachya*—hundreds of scales on each plant during July, August, and September, *Sonchus oleraceus*, *Plantago* spp., *Mentha piperita*, *Stachys æquata*, *Solanum tuberosum*, *Solanum Douglasii*, *Chenopodium murale*, *Chenopodium album*, *Amarantus retroflexus*, *Polygonum persicaria*—stem often entirely covered by scales, *Rumex crispus*, *Urtica holosericea*—a favourite plant, on which the scales developed with unusual rapidity and to large size, *Carex* spp., *Paspalum* spp., *Panicum crus-galli*.

CHARACTERS AND LIFE HISTORY.

The genus *Icerya* was first described by Signoret in the "Annales de la Société Entomologique de France" for 1875, pp. 351, 352, and was founded on the single species *I. sacchari* (Guérin), which occurs on sugar cane at the Island of Bourbon. He knew only two stages, the full-grown female and the newly-hatched larva, but these were described with his customary care.

Mr. Maskell, in describing the species under consideration, places it without much hesitation in this genus, and later, in 1883, still places it in *Icerya*, after examining specimens of *I. sacchari* sent him by M. Signoret. In his original paper (Trans. Proc. N.Z. Inst., 1878, 220), Mr. Maskell describes quite carefully the egg, the young larva, the second stage, and the full-grown female, but had not seen the male lava, cocoon, or adult. Professor Comstock (Ann. Rept. Dept. of Agric., 1880, p. 347) follows Maskell's description quite closely, and introduces no new facts.

There is therefore a necessity for a careful review of the complete life history of the insect, and this we have endeavoured to give in the following pages.

THE EGG.—The egg is quite smooth, elongate-ovate in form, and is of a deep orange-yellow colour. It measures about $0 \cdot 7^{mm}$ in length.

The average number of eggs laid by the females varies according to the vigour of the individual or the condition of the plant upon which she dwells; prolificacy diminishing in proportion as the plant is badly infested—a general law among Coccidæ. Over 800 eggs have been counted in a single egg-mass by Mr. Coquillett, while Mr. Koebele has counted in a single egg-mass, which, by the way, was found upon nettle (*Urtica holosericea*), 940 eggs and 72 young larvæ, while 123 eggs yet remained in the dead body of the female, making a total of 1,135 eggs from the single female.

The time required for the eggs to hatch after leaving the body of the female varies with the temperature. In the winter time the sacs are usually filled with eggs, while in the hottest part of the summer seldom more than one or two dozen will be found in each sac. Some collected by Mr. Coquillett on the 18th of March did not hatch until the 10th of May; but in mid-summer hatching is only a matter of a few days.

THE FEMALE LARVA — FIRST STAGE. — The newly-hatched female larva (and probably the male is identical with it at this stage of growth, since we have not been able to separate them into males and females) is red in colour, inclining somewhat to brown. The body is ovoid in outline, being flattened beneath and convex above. The antennæ are long and 6-jointed. Joint 1 is short and stout, and as broad as long; joints 2, 3, 4, and 5 subcylindrical and subequal, much more slender than joint 1, and twice as long as broad; joint 6 is as long as 4 and 5 together, and forms a long club, at base equalling joint 5 in diameter, but broadening out to twice its width at tip. The basal portion of the club is sometimes distinctly separate from the rest, forming an additional joint. All joints have a few sparse hairs, and the club, in addition to several short ones, bears near its tip four very long ones, each of which is considerably longer than the whole antenna. The legs are thin and brown in colour. The coxæ and femora are moderately large, while the tibiæ and tarsi are long and thin, the terminal joints of the latter bearing several long hairs. The upper digitules are represented by simple hairs, but the lower ones are present and are bent near the base. The eyes are prominent and are each mounted on a short tubercle. The mentum is broad and apparently 2-jointed. The rostrum is broad at base and the rostral setæ are not very long. At the tip of the rounded abdomen are 6 small tubercles, 3 each side of tip, each of which carries a long stout hair, which is as long as the whole body. The body above shows 6 rows of secretory pores, 4 along the middle, and 1 on each side. More or less regular rows of hairs alternate with these pores.

FEMALE LARVA—SECOND STAGE.—According to Maskell and Comstock, there are but three stages of growth in the female after hatching, and these are readily distinguished by the number of antennal joints; the larva of the first stage having 6, that of the second 9, and the adult 11. Messrs. Coquillett and Koebele came to the same conclusions, and all have overlooked a form which we have found quite abundantly among the material we have studied, and which seems to constitute an intermediate stage between the so-called first and second, and which is of course produced by an additional molt which we have personally observed in the field. Hence the so-called "second stage" of these authors becomes third, while the adult female is fourth instead of third, and there are 3 moults instead of 2.

This new intermediate form differs from the female larva of the first stage in the following respects: It is much more rounded and of a stouter general appearance. The antennæ have the same number of joints, 6, but their relative proportions are quite different. The antennæ as a whole are relatively much shorter. Joint 1 is short and stout, its length equalling its breadth; joint 2 equals joint 1 in length, but is not quite so broad; joint 3 is as broad as joint 2, but is twice as long; joints are 4 and 5 are equal in length and width, each narrowing somewhat at base and tip, each considerably narrower than joint 3, and each of the same length as joint 2; joint 6 (club) is of an irregular shape; at base it is as narrow as joint 5, but it broadens until it is slightly wider than 2 or 3, and its tip is narrowed again; its shape is that of an irregular rhomboid with rounded angles and sides, the acutest angles at base and tip. The antennæ carry about the same number of hairs as in the first stage, but those homologous with the four very long hairs of the club in that stage are in this second stage but little longer than the other antennal hairs. The eyes do not appear on the margin of the body, and are only seen on a ventral view. The legs are proportionately much shorter, and the femora are stouter; the trochanters are broader distally, and consequently form a broader triangle in shape. The six tubercles at the anal end of the body are still present, but the hairs which they bear are much shorter. The secretory pores are no longer arranged in rows, but are scattered sparsely over the back and under the sides. The back is more hairy, and the short black hairs occur in irregular tufts.

Female Larva—Third Stage.—That which has heretofore been considered the second stage, and which, as we have just seen, is the third, may be described as follows:

The body is broadly oval in shape and reddish-brown in colour, but is soon obscured more or less by the thick, curly, cotton-like excretion. The antennæ are 9-jointed instead of 6, and are subcylindrical, tapering somewhat from base to tip. Joints 4, 5, 6, 7, and 8 are subequal in length, and each is about as long as broad; joints 2 and 3 are broader and considerably longer; joint 1 is like the corresponding joint in the previous stage; joint 9 (club) is a suboval joint, proportionately much smaller than in the previous stages; it does not exceed joint 8 in width, and it does not quite equal joints 7 and 8 together in length. The long hairs of the club are proportionately quite short. The insect as a whole is much more hairy than in either of the previous stages. The hairs are short and black, and show a marked tendency to grow together in tufts; even when their bases are well separated their tips turn toward each other or toward the common centre of a group; they are quite thickly scattered over the thorax, but less so over the abdomen; all around the edge of the body they appear in close tufts, and the concentric subdorsal ring of tufts which is so prominent in the next stage is plainly seen in this. The secretory pores are scattered irregularly all over the back, and are more numerous than in the previous stage; they also occur under the lateral edges of the body. They are small and circular, and, seen directly from above, have a double outline, indicating a circular central orifice. Around the edge of the body is a row of much larger pores, brown in colour, which protrude from the body, masked by the lateral tufts of hair, each with a circular crown or lip at tip, from which proceeds a long, fragile, glassy tube. The legs and feet are a little stouter than before, the tarsal digitules are shorter, and their enlarged tips quite indistinct. The six anal hairs are still present, though hardly noticeable as they protrude from the mass of shorter hairs.

THE ADULT FEMALE—FOURTH STAGE.—Immediately after the molt by which the insect passes into this stage, it is free from the waxy excretion and presents a broadly oval form, flattened below and quite strongly convex above, with two prominent raised surfaces on the second and third thoracic segments. Its colour is still reddish-brown, with several darker spots, especially upon the front half and along the sides of the posterior half of the body, and the antennæ and legs are black. The antennæ are now 11-jointed instead of 9; joint 1 is nearly twice as wide as long; joints 2 and 3 are subequal in length and thickness and are each somewhat longer than broad; joint 4 is a little more than half as long as 3 and is narrower; joints 5, 6, 7, 8, 9, and 10 increase gradually and slightly in length and decrease very slightly in width; joint 11 (club) is irregularly ovoid and is one and one-half times as long as 10; the special hairs are a little shorter than in the previous stage. The whole body is furnished with short black hairs, more numerous than in the last stage, arranged in tufts, particularly around the edge, where they occur in a double parallel row, the inner row being practically subdorsal and accentuated by a slight ridge. Down the central portion of the dorsum of the abdomen the segments are indicated by the transverse rows of hair tufts. The secretory pores are exceedingly abundant, occurring in enormous numbers just under the lateral edges of the body, and scattered more sparsely over the back. The individual wax filaments which issue from these pores are very delicate and curly, and there is reason to suppose that two or three issue at one time from one pore, as they are frequently seen connected at base; the pore opening, however, seems to have a single simple opening. The inner row of tufts on the back is broken at its anal point by a depression, in which is situated a very large pore, from which the insect occasionally ejects a globule of a semi-liquid honey-dew. This depression is surrounded by an irregular ring of hairs, which are yellowish in colour instead of black. The glassy filaments arising from the large tubular pores described in the last stage are now very long and radiate from the body in almost every direction. They break off easily, yet still often reach a length double that of the insect and her egg-sac together. What is probably the opening of the oviducts is situated on the under side of the seventh abdominal segment. It is surrounded by a transversely oval chitinous ring.

THE EGG-SAC.—As the body of the female begins to swell from the eggs forming inside, the beginning of the egg-sac is made. The female lies flat on the bark, the edges of the body turned slightly upwards, and the waxy material of which the sac is composed begins to issue from countless pores on the under side of the body, but more especially along the sides below. As the secretion advances the body is raised, the cephalic end being still attached, until, near the completion of the sac, the insect is apparently standing on its head, nearly at right angles to the surface to which it is attached. The egg-laying commences as soon as a thin layer of the secretion has formed on the under side of the abdomen, and it continues during the formation of the sac. There soon appears around the edge of the abdomen a narrow ring of white felt-like wax, which is divided into a number of flutings. These flutings grow in length and the mass of eggs and wax under them increases, forcing the female upward until the sac is completed. When completed, it is from two to two and one-half times the length of the female's body. It is of a snow-white colour, and the outside is covered with 15 of these longitudinal ridges or flutings, of subequal size, except that the middle one is smaller than the others. The upper part of the sac is firm in texture, but the lower is looser and thinner, and from the middle of the under side the young make their escape soon after hatching. The size of the sac and the length of time required in its growth depends, leaving the weather and the health of the food-plant out of consideration, upon the number of eggs which the female deposits. So long as oviposition continues, the secretion of wax accompanies it and the egg-mass grows. Concerning the rate of growth Mr. Coquillett gives the following instance:—

"On the 4th of May of the present season I marked a large number of females which were located upon the trunk of an orange tree that was not in a very healthy condition. These females had just begun to secrete the cottony matter, the latter at this date being in the form of short but broad tufts around the margin of the abdomen, those at the hind end of the latter being longest. By the 31st of May the cottony matter was equal in length to one-third of the female's body, and by the middle of July it about equalled in length the entire body of the female. As the egg-masses of some of the females upon the same tree were longer by one-half than the bodies of the females which produced them, it is very probable that at least another month must elapse before the egg-masses of the females which I observed would be completed. It is altogether likely, however, that these egg-masses would have been completed in a shorter time had the females been located upon a healthy tree. The egg-masses found upon healthy trees attain larger size than those found upon sickly trees, owing doubtless to the fact that the females living upon trees of the former kind are more vigorous than those upon unhealthy trees."

THE MALE LARVA—PROBABLE SECOND STAGE.—Neither Mr. Coquillett nor Mr. Koebele were able to distinguish the male larvæ until these had reached the stage in which they form their cocoons. Among the specimens studied at the Department, and which were sent alive from Los Angeles by Mr. Koebele, we have found a larval form which has not yet been described, and which we strongly suspect may be the male in the second stage. * * * * It differs from our supposed second stage of the female in its more slender form, longer and stouter legs, and longer and stouter antennæ. The legs and antennæ are not only relatively longer and stouter, but are absolutely so. The body above is much more thickly clothed with the short stout hairs than the corresponding female stage, and the mentum is longer and darker coloured. The antennæ are 6-jointed, and the joints have precisely the same strange relative proportions as in the female. The secretory pores are present, but are not quite so numerous as in the female.

MALE LARVA—THIRD STAGE.—In this, the third or last larval stage, the male is readily distinguished with the naked eye from the female in any stage by the narrower, more elongate, more flattened, and evenly convex form of his body, as well as by his greater activity in crawling about the trunk or branches of a tree. More careful examination shows that the beak is entirely wanting, the tubercle from which it arises in the earlier stages being replaced by a shallow triangular depression. The body is almost naked, being very sparsely covered with a short, white, cottony matter, and is destitute of the short but stout black hairs which are found upon the body of the female during the third and fourth stages of her life. In the absence of black spots and in the 9-jointed antennæ he agrees with the similar or third stage of the female, and the average length when full grown is about 3^{mm} and diameter about 1^{mm}.

THE MALE PUPA AND COCOON.—When the male larva has reached full growth and is ready to transform it wanders about in search of a place of concealment, finally secreting itself under a bit of projecting bark, under some leaves in the crotch of the tree, or even wedging itself down under a mass of females. Very frequently, probably in the majority of cases, it descends to the ground, and hides under a clod of earth or works its way into some crack in the ground. Having concealed itself it becomes quiescent, and the delicate flossy substance of which the cocoon is formed begins to exude abundantly from the body. This material is waxy in its character, but is lighter and more flossy and less adhesive than that of which the egg-sac of the female is composed. After a certain amount has been exuded the larva moves backwards very slowly, the exudation continuing until the mass is from 7^{mm} to 10^{mm} in length. From this method of retrogression it happens that the body of the larva is frequently seen protruding posteriorly from the mass, which naturally leads to the erroneous conclusion that the material is secreted more abundantly from the fore part of the body, whereas the reverse is the case. When the mass has reached the proper length the larva casts its skin, which remains in the hind end of the cocoon, and pushes itself forward into the middle of the cocoon.

The pupa has the same general colour as the larva, the antennæ, legs, and wing-pads being paler and the eyes dark. It has also the same general form and size. All the members are free and slightly movable, so that they vary in position, though ordinarily the antennæ are pressed close to the side, reaching to basal part of metathorax (ventrally); the wing-pads also against the side, elongate-ovate in form and reaching to second abdominal joint. The legs are rather shorter than the diameter of body, and the front pair thrust forward. The anal end is deeply excavated, the abdominal joints well separated, the mesonotum well developed, and the pronotum tuberculous or with some eight prominences; but there are no other structural peculiarities. The surface is, however, more or less thickly covered with waxy filaments, which are sometimes exuded in sufficient quantities to give quite a mealy appearance.

Whenever the pupæ are taken from the cocoon and placed naked in a tin box they exude a certain amount of wax, often enough to partially hide them from view. If disturbed they twist and bend their bodies quite vigorously.

The cocoon is of an irregular elongate shape, appearing a little denser in the centre, where the pupa has placed itself, and at the edges delicate and translucent. The material of which the cocoon is composed is very delicate, and appears like the finest cotton, but on submission to a gentle heat it melts as readily as the coarser secretion of the female, and leaves the larva or pupa, as the case may be, clean and exposed.

THE ADULT MALE.—A careful description of the male of this species has never been published. It was unknown to Mr. Maskell at the date of his first paper and has not been mentioned in any of his subsequent papers. Mr. Trimen attempted to breed it, but was unsuccessful. He says: "So little is certainly known of the males of the Coccidæ that I "have kept from time to time a large number of this Dorthesia under "glass in the hope of obtaining the males, but hitherto without success. "I once, however, found on my window a male of some Coccus which "I thought was very probably that of the introduced species, as it "agreed in most of its important characters with Westwood's figure of "the male *Dorthesia characias.* It was dark red, with the wings gray, "and very slender and fragile in its structure. It measured $\frac{15}{48}$ inch "across the expanded wings."

The male was unknown to Professor Comstock, but was very briefly mentioned by Dr. Chapin in the first report of the Board of State Horticultural Commissioners, Sacramento, 1882, p. 68. He found the male in numbers during a period of two weeks from September 25, 1881, but did not observe it in 1882. It is also mentioned by Matthew Cooke in his "Injurious Insects," &c., 1883, p. 166, and a rough and uncharacteristic figure is given at Fig. 146, Plate 3. His few words of description are: "Male insect, winged; colour, thorax and body dark "brown; abdomen, red; antennæ, dark coloured, with light hairs "extending from each joint; wings, brown, iridescent." The following detailed description is drawn up from numerous specimens, both mounted and living:—

"The adult male is a trifle over 3^{mm} in length, and has an average wing expanse of 7·5^{mm}. The general colour is orange red. The head above is triangular in shape, with the apex blunt and projecting forward between the bases of the antennæ. The eyes are placed at the other apices of the triangle, and are large, prominent, and furnished with well-marked facets. There are no mouth parts, but on the under side of the head is a stellate black spot with five prongs, one projecting forward on the conical lengthening of the head, one on each side to a point just anterior to the eyes and just posterior to the bases of the antennæ, and the remaining two extending laterally backwards behind the eyes. The antennæ are light brown in colour, and are composed of ten joints. Joint 1 is stout, almost globular, and nearly as broad as long; joint 2 is half as broad as 1 and is somewhat longer; joint 3 is nearly twice as long as 1 and slightly narrower than 2; joints 4, 5, 6, 7, 8, 9, and 10 are all of about the same length as joint 3, and grow successively a little more slender; each joint, except joint 1, is furnished with two whorls of long light-brown hairs, one near base and the other near tip; each joint is somewhat constricted between its two whorls, joint 2 less so than the others. There are no visible ocelli. The pronotum has two wavy subdorsal longitudinal black lines, and the mesonotum is nearly all black, except an oval patch on the scutum. The metanotal spiracles are black, and there is a transverse crescent-shaped black mark, with a short medium backward prolongation. The mesosternum is black. The legs are also nearly black and quite thickly furnished with short hairs. The wings are smoky black, and are covered with rounded wavy elevations, making a reticulate surface, a cross section of which would appear crenulate. The costa is thick and brown above the subcostal vein, which reaches costa at a trifle more than four-fifths the length of the wing. The only other vein (the median) is given off at about one sixth the length of the wing, and extends out into the disc a little more than one half the wing length. There are, in addition, two white lines, one extending out from the fork of the subcostal and the median nearly straight to the tip of the wing, and one from the base in a gradual curve to a point some distance below the tip. Near the base of the wing below is a small ear-shaped prolongation, folded slightly on itself, making a sort of pocket. The halteres are foliate, and furnished at tip with two hooks, which fit into the folded projection at base of wings. The abdomen is slightly hairy, with the joints well marked, and is furnished at tip with two strong projections, each of which bears at tip four long hairs and a few shorter ones. When the insect is at rest the wings lie flat upon the back."

Rate of Growth of the different Stages.

The rate of growth of the insect necessarily depends so much upon surrounding conditions, and especially on the mean temperature, that it is difficult to make any definite statements as to time elapsing between molts or that required for other periods of the insect's growth. No facts have hitherto been published which bear upon this point. Mr. Coquillett's observations show that individuals hatched from eggs on the 4th of March cast the first skin on the 23rd of April, and underwent the last moult on the 23rd of May. Mr. Koebele also reports a case which bears upon this point, and which is interesting as occurring later in the season. He placed four newly-hatched larvæ on a healthy young orange tree, out of doors, August 5. On September 26 two of them passed through the first moult. October 10 one more moulted, and on October 23 the fourth cast its first skin. All left the leaves after moulting and settled on young twigs. None of them had gone through the last moult when he left Los Angeles, November 6. He was afterwards informed by Mr. Alexander Craw, of Los Angeles, that nearly all of the insects were full grown in February, and he therefore concluded that the individuals observed by him would not attain full growth before that time.

The mature male larva requires on an average about 10 days from the time it begins to form the cocoon before assuming the pupa state, and the pupa state lasts from two to three weeks. The more reliable information we have been able to obtain would show that at Los Angeles the average number of generations each year is three.

HABITS.

The newly-hatched larvæ settle upon the leaves and tender twigs, insert their beaks, and imbibe the sap. On passing into the third stage they seem to prefer to settle upon the smaller twigs, although a few are found upon the leaves and still fewer upon the larger branches and trunk. The adults, however, almost invariably prefer the trunk and largest branches.

The insect is rarely found in any of its stages upon the fruit.

The species differs markedly from most Coccidæ in being active during the greater part of its life, though most of the travelling is done by the female immediately after the third molt and by the male just before settling to make his cocoon. At these periods they wander up and down the trunk and larger limbs until they find some suitable place, when they settle down, the male to pupate and the female to insert her beak and develop her eggs and their characteristic waxy covering. She is capable of slow motion even after oviposition has commenced, but rarely does move unless from some exceptional cause. In thus settling after their last wanderings both sexes are fond of shelter and will get under any projecting piece of bark or under bandages placed around the tree, the male often creeping under clods of earth. Both the female and the male, in adolescence, are most active during the hotter parts of the day and remain stationary at night: but the perfect or winged male is rather sluggish during the day, usually remaining motionless on the under side of the leaves of low plants or high trees, in crevices of the bark, or wedged in between females on the tree. There seems, in fact, to be a well-marked attempt at concealment. The recently developed individuals are found abundantly on or under clods of earth near their pupal cocoons, and they issue most numerously during the latter part of the afternoon. They are at first weak, awkward, and ungainly, and instinctively seek some projection on the tree or elevation on the ground from which to launch on the wing.

At the approach of night they become imbued with a very high degree of activity and dart rapidly about on the wing. At such times they swarm around the infested trees, and many of the females, even some with large egg-masses, hold their bodies raised obliquely from the bark, as though aware of the presence of the males. In September and October Mr. Koebele noticed that the males began their flight about 5 o'clock, and as soon as it was fairly dark they again settled down to rest. None have been observed flying at night and none have been attracted to the electric lights.

EXUDATION OF THE HONEY-DEW.

It required but a few hours upon our first visit to Los Angeles, the latter part of March, to become familiar with the insect in all its habits and conditions, as at that season the species is to be found in all conditions from the egg through all the stages of both sexes. But the characteristic of this remarkable insect which most obviously attracted our attention and distinguished it from all other species of the family, even where there were no gravid females with the fluted cushion, was the saccharine exudation. As with most Aphids and Coccids, this sweet liquid is exuded at all stages of growth, but is most copious from the adult female just before oviposition begins. It is expelled with considerable force from the large pore already described, and in hot weather with sufficient rapidity to produce all the effects of honey-dew. Usually it is limpid enough to soak and discolour the trunk and to drop as it accumulates from the leaves, sometimes being so copious as to remind one of a shower; but at other times, and especially during dry weather, the sugar condenses and forms large drops or masses of white, semi-opaque, sirupy liquid, which adheres to and often completely covers the insect, so that the trunk of the tree looks much as if it had been bespattered with caustic potash or melted stearine. At other times the liquid parts evaporate entirely and leave masses of pure white powdery sugar.

Honey-loving insects seek this sugary secretion in numbers, and it is always followed by the black mold or smut (*Capnodium citri*), which is so universal an accompaniment of all honey-secreting Homoptera, living as it does on the saccharine deposit. The secretion being so very copious from Icerya, the smut is equally thick and copious in her wake. Indeed, the great prevalence of this smut in the Icerya-infested groves of California (rendering it necessary to wash or cleanse the gathered fruit) is as characteristic of the Pacific coast as the rusty effect of the Rust-mite (which is unknown there) is of the orange groves of Florida.

MODE OF SPREAD AND DISTRIBUTION.

The spread of this species will be aided by very much the same agencies that affect the spread and dissemination of other species of scale-insects. We have already, in 1868, in treating of the Oyster-shell Bark-louse of the Apple,* and again four years later,† discussed the principal methods by which such spread is promoted, viz., by the agency of wind and running water; by the young being carried upon birds and other animals, particularly flying insects frequenting the same trees; but primarily by transport upon scions and nursery stock.

In insects like the Coccidæ, where the locomotive power is confined for the most part to a few days in early larval life, the species would be very much restricted in range, and would never pass from one country to another, except by some of the agencies above indicated. Our observations since we first wrote upon this subject, as well as the extended observations of Mr. Hubbard in Florida, and given in the special report on Insects affecting the Orange, as also Mr. Coquillett's observations on the distribution of the particular species in question, all go to confirm the potency of these means of distribution. Thus Mr. Hubbard found that lady-birds (Coccinellidæ), and more particularly gossamer spiders, are active agencies in such distribution. The agency of the wind, as indicated by the more rapid spreading in the direction of prevailing winds, has often been verified. Mr. Coquillett reports: "In the infested "part of this city (Los Angeles) is a large vineyard, and on both the "north and south sides of it is an orange orchard infested by these "insects; but, while the recently-hatched insects occur on the vines as "far out as the tenth row of grape vines on the south side of the vine-"yard, they are not found upon the vines beyond the third row on the "north side, the wind, as stated above, blowing from the south-west. "No adult females are to be found on any part of this vineyard, and "the young insects must have been carried by the wind from the "infested orange trees on either side of the vineyard." Our own experience in California showed that similar evidence of the influence of the prevailing wind in promoting the spread of the species is general.

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* First Report Insects of Missouri, p. 15.

† Fifth Report Insects of Missouri, pp. 85, 86.

While Mr. Hubbard's observations show that the action of the wind is indirect rather than direct, by influencing the flight of winged insects and the floating of spiders which transport the scale-insects, yet we have every reason to believe that winds have a much more direct influence than is generally supposed, especially in the case of severe storms passing over infested districts at the right season. We laid emphasis on this in our earlier writings, and Mr. Coquillett, while admitting the influence of birds, insects, and water in the transportation of our *Icerya*, lays greatest stress upon the direct agency of the wind. Young scale-insects are not easily dislodged, but where a tree is badly infested there is every reason to believe that they instinctively drop from the terminal twigs, and their specific gravity is so slight, that they may be carried long distances in strong wind currents.

In regard to the influence of birds upon the spread of the Cottony Cushion-scale, Mr. Coquillett observed that whenever the nest of a bird is found upon a tree recently infested with this insect, the latter will be found to be most numerous in the immediate vicinity of the nest, thus indicating that the young had been accidentally brought there and in considerable numbers by the old birds. There is no doubt also that the irrigating ditches have a very marked influence on the spread of the species, as many of the ditches pass under infested trees, and the waxy secretion serves both to protect the insect from the water and to facilitate floating.

While, therefore, the gradual spread from orchard to orchard is in the main through the agency of other flying insects and gossamer spiders, yet the transportation of the pests to long distances must necessarily be effected through the agency of high winds, birds and man in commercial intercourse, the latter being probably the only means by which the species have been introduced from one country to another separated by wide ocean areas.

NATURAL ENEMIES.

BIRDS.—The natural enemies of the Cottony Cushion-scale seem to be very few in number, not only in California but also in South Africa and New Zealand. In South Africa the only bird which is recorded as feeding upon this scale is the common "White Eye" (*Zosterops capensis*), and this is given by Mr. Trimen upon hearsay evidence only: "I have not noticed any of our small birds attacking the *Dorthesia*, "but Mr. C. B. Elliott tells me that his boys have observed the little "'White Eye' * * * pecking at them." From what we have been able to learn of the habits of this bird, however, we are inclined to think that it is attracted rather by the abundant secretion of honey-dew and the minute insects caught in it than by the scale-insects themselves.

Neither Mr. Coquillett nor Mr. Koebele observed any bird feeding upon it. The reason for this exemption is probably the copious secretion of wax, which is doubtless distasteful. Several reliable persons report that ducks and chickens feed greedily upon those scale-insects which are dislodged from the trees. * * * * *

PREDACEOUS INSECTS.—The only predaceous insect observed by Mr. Coquillett to feed upon the Cottony Cushion-scale was the larva of a species of Lace-wing fly (*Chrysopa* sp.), which was not bred and cannot be named more exactly.

The Ambiguous Lady-bird (*Hippodamia ambigua*) has been noticed feeding upon the eggs when they were exposed to view by the egg-sac being broken open; but neither this nor any other species of Lady-bird was seen to feed upon the adult insect, although commonly attracted by the honey-dew secreted.

Among the predaceous insects found by Mr. Koebele and sent to us for study we may mention first the larva of a small moth (*Blastobasis iceryæella* n. sp.), although as yet we are not certain that it ordinarily preys upon the living and uninjured scale-insects or their eggs. Like certain other so-called predaceous Lepidoptera, it may be attracted primarily by the waxy secretions of the bark-lice, and only incidentally destroy the insects and their eggs. These larvæ were often found feeding in the egg-masses of females which had been destroyed by soap washes, and also in sacs the eggs of which had hatched some time previously, but never upon fresh eggs. One of the larvæ, kept in a glass tube with living scales and fresh eggs, fed slightly on the waxy mass, but did not thrive until after the scales died. It then fed upon the dead scales and moulted, but died before transforming. Two nearly full-grown larvæ fed readily on dead scales which were still soft, and passed through their transformations successfully. The same insect fed readily upon the Black Scale (*Lecanium oleæ*), in this case eating the living insects and their eggs, forming a silken tube along the twig, and passing from one scale to another, just as does the Coccid-eating Dakruma (*Dakruma coccidivora*)* in feeding upon the Cottony Maple-scale at the East.

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The most efficient destroyer of the Cottony Cushion-scale at Los Angeles is perhaps a species of earwig, family Forficulidæ neither the genus nor species of which we are able to determine, from the fact that we have only seen immature specimens. According to Mr. Koebele this insect is often met with among the scales, and, from observations which he made, feeds greedily upon the Icerya in all stages, tearing open the egg-masses and eating the eggs, and also tearing and eating the mature insects as well as the larvæ.

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* We have bred a species of *Dakruma* the past season, indistinguishable from *D. coccidivora*, from the Cochineal insect (*Coccus cacti*) received from Dr. A. F. Carrothers, of San Antonio, Tex., who collected the specimens at his ranch (Iuka ranch) near Cotulla, La Salle County, Texas.

In a recent communication from Miss Ormerod, already mentioned on p. 196, she writes as follows of a predaceous insect discovered by her correspondent, Mr. Bairstow, of Port Elizabeth, Cape Colony:—

"It will perhaps be of some interest to mention that Mr. Bairstow has found a species of Coccinella which has proved (as far as our coleopterists are aware) to be previously undescribed, to be so exceedingly serviceable in destroying the 'Australian bug,' as they call it, that he has been supplying it to applicants. Dr. Baly examined the specimens sent over for me, and I propose to notice it, with full technical description and a figure, as *Rodolia iceryæ*."

PARASITES.—It is a somewhat remarkable fact that no true parasites were ever bred from the Cottony Cushion-scale until the past summer, and still more remarkable that in the course of their careful investigations, extending over a space of six months, neither Mr. Coquillett nor Mr. Koebele succeeded in finding a single parasite upon this insect. From a number of scales, however, sent to Washington by Mr. Koebele, November 10, we bred, on December 8, two specimens of a small Chalcid, which is, without question, a true parasite of Icerya, as the female scales from which they escaped were found each with a small round hole in its back.

This little parasite is prettily marked with black and yellow. It is new to our fauna and may have been imported with its host.*

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REMEDIES AND PREVENTIVE MEASURES.

We have indicated in the introduction to this report the more important results of the experiments carried on at Los Angeles by Messrs. Coquillett and Koebele, and as their reports are later given in full we shall refrain from entering into detail here, and state only a few of the more important convictions that impressed us after the first week's experience in the orange groves of California.

IMPORTATION OF PARASITES.—The general importance of the introduction of parasites which affect a species in its native land, and which have not accompanied it into the land of its introduction, has been insisted on in our earlier writings and in those of others, and the ease with which this may be done in the case of the more minute parasites of scale insects adds to its importance in their connection. Considering the fearful losses already occasioned to California orange growers by two species (the *Icerya* in question and the California Red Scale), introduced from Australia, we know of no way in which the Department could more advantageously expend a thousand dollars than by sending an expert to Australia to study the parasites of the species there and secure the safe transport of the same to the Pacific coast; and the fact that the Commissioner of Agriculture is prevented from doing so by restrictions imposed on the Division of Entomology is a sad commentary on the narrow Congressional policy which seeks to limit and control administrative action in details which can neither be properly understood nor anticipated by committees.

PREVENTIVE ACTION.—The value of clean culture and fertilizing where necessary to induce vigorous growth, but more particularly of wise pruning, so as to let in the sun and rain to the heart of the tree, has been set forth in the special report of the Division on the Insects affecting the Orange, by Mr. Hubbard, and apply equally to California as to Florida. We have also been particularly impressed with the value of wind-breaks of coniferous trees not affected by the Coccidæ that infest the Orange, both as shelter to the trees and as screens to prevent the spread of the *Icerya* from invested trees outside the grove.

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* This parasite is described by Mr. Howard as *Isodromus Icerya*, How.

SPRAYING WITH INSECTICIDES.—The orange-growers of the Pacific have suffered greatly from the advice and recommendations of biased or interested persons, who were prejudiced in favour of their own particular remedies, and were for a long time unwilling to profit by the results of thorough and careful experiments which we have for some years conducted in the East, and which are in the main embodied in Mr. Hubbard's report. A pretty thorough personal survey of the field has convinced us that while the resin soaps experimented with by Mr. Koebele are a valuable addition to our insecticides for the orange Coccidæ, yet in the main our experience in Florida is repeated in California, and all the more satisfactory washes have kerosene as their effective base. There has been, and is, however, a very great waste in applying it, and where from 10 to 50 or more gallons have been used on a single tree, from 2 to 4 would suffice.

We cannot urge too strongly the fact that in the case of this *Icerya*, as most other orange-feeding Coccidæ, it is practically impossible, with the most careful and thorough spraying, to reach every one of the myriad individuals on a good-sized tree. Some few, protected by leaf-curl, bark-scale, or other shelter, will escape, and with their fecund progeny soon spread over the tree again if left unmolested. Hence two or three sprayings at intervals of not more than a month are far preferable to any single treatment, however thorough; and this is particularly true of the *Icerya*, which occurs on so many other plants, and which in badly-infested groves is crawling over the ground between trees. It is now the custom to use the time of a team and 2 men for fifteen to twenty minutes or more, and 10 gallons and upward of liquid on a single medium-sized tree. In this way the tree is soaked until the fluid rains to the ground and is lost in great quantities, some growers using sheet-iron drip-plates around the base of the tree to save and re-use the otherwise wasted material. This is all wrong so far as the oil emulsion is concerned, as the oil, rising to the surface, falls from the leaves and wastes more proportionally than the water.

The essence of successful spraying of the kerosene emulsion consists in forcing it as a mist from the heart of the tree first and then from the periphery, allowing as little as possible to fall to the ground and permitting each spray particle to adhere. It is best done in the cool of the day, and, where possible, in calm and cloudy weather. With one fifth of the time and material now expended in California the spraying should be successfully done, so that three sprayings at proper intervals will be cheaper and far more satisfactory than only one as ordinarily conducted. In this particular neither Mr. Coquillett's nor Mr. Koebele's experiments are entirely satisfactory, as we were so far from the field while they were being carried on as to render any special direction of them impossible. Both strove for the practically impossible, viz., the destruction of all insects by a single application. Mr. Koebele's estimate of the cost of the kerosene wash is also too high, as he used it much stronger than necessary. The resin compounds may doubtless be used to advantage in connexion with the kerosene emulsions; but anything which will give permanence and preventive character to the wash will add greatly to its value. Without going into details as to reasons, we would therefore recommend the addition to every 50 gallons of the kerosene-soap wash, made after the usual formula, 3 ounces of arsenious acid. Though the arsenical preparations are mainly effective against mandibulate insects, by poisoning through the stomach, they have also more or less effect by contact, and we are strongly of the opinion (which we hope soon to verify) that this combination, for the first time recommended, will give the spray most lasting effect, and that the few insects which escape the direct spray will be destroyed as they subsequently leave their protecting retreats or hatch from eggs and crawl about the tree. As a means of arresting the growth of the black-mould (which is, however, only the indirect consequence of the Coccid), so troublesome an accompaniment of the *Icerya*, a small proportion of sulphate of copper might also be added.

Just as there is now a great wastage of time and material in drenching a tree, so the spraying nozzle most in vogue in California is also wasteful. That most commonly used is the San José nozzle, in which the water is simply forced through a slightly flaring terminal slit in a more or less direct and copious jet. The force and directness of the spray give this nozzle its popularity under the mistaken spraying notions which prevail, and to this we must add the fact that, being a patented contrivance, it is well advertised and on the market.

The cyclone nozzle has not yet had proper trial to impress its advantages, having scarcely been known prior to the experiments of Messrs. Coquillett and Koebele. That made and sold by G. N. Milco is patterned in size and aperture after that which we designed to spray from near the surface of the ground. What is wanted for an orange grove or for trees is a bunch of nozzles of twice the ordinary size and capacity, the size of the outlet to be regulated by the force of the pump. There is no form of nozzle so simple and so easily adjustable to all purposes. We strongly recommend a bunch of four nozzles of twice the ordinary size and thickness, one arranged so as to have the outlet distally or at one end of the piping (which may be ordinary gas-pipe) and the other three on branches, so that the outlet is at right angles, each about an inch below the other, and so placed that they are separated by one third the circumference of the main pipe. Such a bunch, with apertures properly adjusted to the occasion, worked from the centre of the tree, will envelop it in a perfect ball of floating mist, which in a very short time will imbue all accessible parts. For tall trees a more forcible direct spray might be sent from the end by substituting an ordinary jet and the wire extension, which is simply an extension tube screwed over the nipple, the end of the tube being covered with wire netting, which breaks up the liquid forced through it, and which for force and fine division of the particles has some advantages over the San José nozzle. Finally, if a series of blind caps and several sets of caps of varying aperture are kept on hand, the spray may be adjusted at will, and to suit the conditions of wind, pump force, &c. that have to be dealt with.

FUMIGATING.—Fumigating the trees will always have the disadvantage, as compared with spraying, that the mechanism is more cumbersome, the time required greater, and the first cost in making preparation heavier; and these factors will always give spraying the advantage with small proprietors or those who have to deal with young trees. As an offset to these drawbacks fumigation has the merit of more effectually reaching all the insects upon a tree, and this alone would under some circumstances justify the greater first cost and trouble in preparing movable tents for the purpose, providing always that a gas, vapour, or fume be discovered that will rapidly kill all the insects without injuring the tree; virtues not easily combined in such subtile media.

In Florida proper spraying has been found to be so effectual and satisfactory that no elaborate experiments in fumigating have been undertaken, and we are fully satisfied that proper spraying will also prove sufficient in California. But so much poor work has been done and so many defective washes used that many growers have become discouraged and quite a disposition has been shown to either cut down the trees or resort to fumigation as a last resource. In connection with Mr. Alexander Craw, Mr. Coquillett has conducted some experiments in the Wolfskill orchard at Los Angeles, which lead them to believe that they have discovered a gas which possesses the requisite qualities, and trees that had been treated and which we examined pretty carefully would seem to justify their hopes. Several ingenious movable-tent contrivances are also being developed in Los Angeles County that give promise of practical utility and feasibility, and which we may have more to say about on some future occasion.

BANDAGES AROUND THE TRUNK.—There is always danger that a tree once sprayed will get reinfested from the insects that have not been reached upon adjacent plants or upon the ground, and which in time crawl up the trunk. Any of the sticky bandages used for the canker-worm will check this ascent, but when placed directly on the trunk may do more harm than good. They should be placed upon strips of tar or other stout paper or felting, tied by a cord around the middle, the upper end flared slightly outward, and the space between it and the trunk filled with soil, to prevent the insects from creeping beneath. Cotton should not be used for this purpose, as birds for nesting purposes carry away particles of it containing the young insects, and thus help to disseminate them.

CONCLUSION.—All possible care should be taken in cultivating and harvesting the crop to prevent dissemination of the young upon clothing, packing-boxes, &c., and too much care cannot be exercised in endeavours to prevent the introduction of the species from infested to non-infested regions. Next to destructive locusts no insect has been more fully legislated against than this *Icerya* in California. Yet while some good has resulted, the laws have too often proved inoperative, either through the negligence or ignorance of the officers appointed to execute them, or, more often, the indifference of the courts and their unwillingness to enforce them with vigour.

The pest has come to stay. No human endeavour can exterminate it. But it may be controlled, and while the greatest possible co-operation should be urged, and, if possible, enforced, yet each orange-grower must in the end depend upon his own exertion; and we say to them, individually and collectively, that there is no occasion for discouragement. This insect has made profitable orange-growing on the Pacific coast more difficult and more of a science; but, by making it impossible at the same time for the shiftless to succeed in their business, it will come to be looked upon as a not unmixed evil.

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ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 33.] SEPTEMBER. [1889.

CVI.—FLOWERS OF CALLIGONUM AS AN ARTICLE OF FOOD IN N.W. INDIA.

The transfer to the Royal Gardens in 1879 of the economico-botanical collections formerly forming part of the India Museum at South Kensington enforced upon Kew the duty of maintaining on exhibition a complete set of specimens of Indian products. Every effort has therefore been made, with the ready assistance of the India Office, to make this as perfect as possible, and particular attention has been paid to vegetable products used for food, the nutritive value of a large number of which has been elaborately discussed by Professor Church, F.R.S., in his *Food Grains of India* (published for the Committee of Council on Education, Chapman and Hall, 1886). Supplementary analyses of articles not included in that work have from time to time been kindly contributed by Professor Church to the *Kew Bulletin* (see *Bombusa Tulda* and *Panicum flavidum*, December 1887; *Coix gigantea*, November 1888).

The use of flowers as an article of food is somewhat uncommon. Mere fugitive structures for the most part, their transitory purpose precludes the plant wasting upon them any of its carefully economised

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1889.

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store of reserve-materials. It is the natural accumulations of these reserve-materials, whether in the fruit, the seed, the stem, the tuber, or the root, which mankind has learnt to appropriate and divert to its own use. And the flower is rarely available in this way. The use of Lily flowers by the Chinese, discussed in the *Bulletin* for May 1889, is scarcely an exception, as these are used as little more than a condiment. India, however, affords more than one instance of flowers having a real value as articles of food. The well-known Mahwa tree (*Bassia latifolia*) is an example. Sir Dietrich Brandis states (*Forest Flora of North-west and Central India*, p. 290) :—" The succulent flowers fall by night in " large quantities from the tree, and are gathered early in the morning ; " they have a sickly taste, and smell. They are dried in the sun, sold " in the bazaar, and form an important article of food in many parts of " India. They are eaten raw or cooked, often with parched grain, and " put in sweetmeats."

Another instance is afforded by the flowers of *Calligonum polygonoides*. Attention having been drawn to the fact that the Kew Museum contained no specimen of this curious product, the following letter was addressed to the India Office :—

ROYAL GARDENS, KEW, to INDIA OFFICE.

Royal Gardens, Kew,
April 12, 1888.

SIR,

I AM desired by Mr. Thiselton Dyer to inform you that in certain parts of India, such as Sind, the Punjab, and Rajputana, it is said that abortive flowers of a plant known locally as *balanja*, *berwaja*, and *tantuke* in Afghanistan, as *phok* or *phog* in the Punjab and Sindh, and to botanists as *Calligonum polygonoides*, L. (natural order, Polygoneæ), are used " made into bread or cooked with ghee."

2. A description of the plant is given by Sir Dietrich Brandis in the *Forest Flora of North-west and Central India*, p. 372, and by Gamble in *A Manual of Indian Timbers*, p. 303.

3. Mr. Thiselton Dyer would be glad to obtain for the Museums of Economic Botany at Kew samples of the dried flowers of the plant in question, together with any preparation of them in the form of bread or otherwise which may be available.

I am, &c.,
(Signed) D. MORRIS.

J. A. Godley, Esq., C.B.

INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,
June 15, 1889.

SIR,

WITH reference to the letter from this Office of the 14th May 1888, I am directed by the Secretary of State for India to forward herewith, for your information, a copy of a " Note on an article of food prepared from the flowers of the Phog " (*Calligonum polygonoides*), by Mr. J. F. Duthie, Director of the Botanical Department, Northern India, and to inform you that a tin case received from India, containing specimens of the above-mentioned plant has been sent to your address.

I am, &c.,
(Signed) C. E. BERNARD,
Secretary, Revenue and
Statistics Department.

The Director,
Royal Gardens, Kew.

[Enclosure.]

NOTE on an Article of Food prepared from the Flowers of "Phog" (*Calligonum polygonoides*).

EXTRACTS from Dr. J. L. Stewart's *Punjab Plants*, p. 183.

Calligonum polygonoides, L. Vernacular Trans-Indus, *balanja berwaja, tatuke*, Cis-Indus, *phok, phog ;* flowers *phogalli.* This which is a moderately sized shrub, was first noticed by Elphinstone *en route* to Kábul, who mentions it as abundant, and notes the use to which its flowers are put from Shekhawuttee to the Sutlej * * * The plant is reported on good authority to be abundant in the Bikanir desert, but I have not seen it east of the Sutlej to the northward of that. It is not uncommon to the west of Shahpur, and for some miles north of Jhang, and is abundant in the Bari Doab in places southward from 60 miles north of Multan, and it forms a great part of the jungle westward from Mozaffargarh for some miles. It is also common near the southern and eastern skirts of Shaikh Budin, and occurs near Rajanpur in the southern Trans-Indus. I also saw it in Sind, * * * * * Cis-Sutlej, and in the southern Punjab. The flowers, having fallen off, are swept up from the ground, and used largely as food (not, however, Trans-Indus apparently). Coldstream states that in Mozzaffargarh they are made into bread, or are cooked with ghi and eaten as a relish.

EXTRACTS from Dr. J. L. Stewart's MS. *Forest Flora of Northern India.*

Common on plains, locally in various arid parts of the Punjab, Cis- and Trans-Indus, south of a line and somewhat north of the latitude of Lahore; most abundant of all for some way west of Mozzaffargarh, where it constitutes in places half of the larger vegetation, and except after showers there is almost no herbaceous growth, *Salvadora oleoides* being the other half. Also occurs in Sind along bases of hills, and although it has not been got in Ferozpur or Harriana, east of the Sutlej, is noted to be one of the most abundant and characteristic plants of the Bikanir Desert to the south, where Elphinstone in his journey to Kábul early in the century was the first European to notice it in India; also got by Griffith in N.E. Afghanistan to 5–6,000′; and grows in Persia, Arabia, Syria, Armenia, Egypt, Algeria, and the Canaries * * * * *

Grows somewhat gregariously, often on hummocks of heavier soil, and generally in clumps, like most plants in very arid soils, in the most dry and sandy places, often where the soil is very saline. Usually a small densely branched shrub 3–4 feet high, but when old, a rambling, loose, aphyllous shrub with stems 2½ feet girth at base, the branches spreading, divergent, in all directions, sometimes tree-like to 12–15 feet high, rather showy and peculiar-looking when fresh and in flower * * * * *

Its young leaves appear about February, March, and though the "verdure" of its appearance of which Madden writes is not very striking, it is a welcome and pleasing enough object in the arid deserts of North India about April, when the multitudinous small reddish pinkish flowers issue on the branches, filling the air with a strong pleasant odour as of over-ripe strawberries, and in May when these have resulted in the curious little wig-like fruit which ripens about June * * * * * * * *

EXTRACT from letter of 2nd April 1889 from the Deputy Conservator of Forests, Multan Division, to the Director, Botanical Department, Northern India.

It appears that the flowers are gathered and used by the poorer classes only. They are cooked in two ways: (*a*) mixed with flour in the proportion of one-fourth to one-third phog flowers to flour; (*b*) separately with salt and condiments, to which those who are able add a little ghee; this preparation is eaten with the ordinary "roti" as a relish like "dál" * * *

The flowers are kept for a night in a closed earthenware vessel so as to fade, but it appears that they may be kept for a long time. I send a specimen of last year's flowers.

In Mozaffargarh the season for gathering seems to be just over, as the plants are in fruit.

EXTRACT from letter dated 6th April 1889 from Capt. G. Wingate, Assistant Commissary-General, Rawal Pindi, to the Director, Botanical Department, Northern India.

I enclose herewith a specimen of the phog bush with flowers and seeds, which I have procured from the Mozaffargarh district * * * *

Only the poorest classes use the flower as food to help out the supply of better food. They collect the flowers, keep them usually in an earthen vessel over a day, then cook them with salt or other condiments, and, if they can afford it, with ghee, and then the mass is eaten as a sort of vegetable or very much in place of the dáls eaten with rice in Bengal * * *

Sometimes the flowers are kneaded up in the thin atta, about one-fourth flowers to three-fourths atta, and baked in cakes and eaten * * *

The flowers keep well for a long time.

It will be interesting to ascertain the value of this particular kind of food, consisting as it does of the abortive flowers of a plant belonging to a family the seeds of which, as in the case of buckwheat, from the usual edible portion of the plant.

(Signed) J. F. DUTHIE,
Director, Botanical Department,
Northern India.

Simla, 1st May 1889.

A portion of the phog flowers received from the India Office was placed in the hands of A. H. Church, Esq., F.R.S., Professor of Chemistry to the Royal Academy. He has obligingly furnished the results of his examination in the following memorandum.

"I have submitted the sample of *phog* to analysis in order to ascertain its nutritive value. The flowers were taken exactly in the condition in which they were received, with the single exception, that a few stalks, which would have been difficult to grind into powder, were first removed. The results of my first examination are here given:—

Water - - - -	11·0	per cent.
Oil, &c. - - - -	6·4	"
Albuminoids - - -	16·7	"
Sugar, &c. - - - -	46·1	"
Cellulose - - - -	10·0	"
Ash - - - -	9·8	"

"The following observations may be useful in the further elucidation of the above analytical numbers. The "oil, &c." represents the per-centage of matters extracted by ether, which though usually regarded as oil or fat, really contain traces of wax, resin, colouring matter, &c. The 'albuminoids, &c.' were obtained by regarding the whole of the nitrogen present as existing in the albuminoid form. It was found, however, that by the phenol method, the per-centage of coagulate albuminoids did not exceed 12·53; this shows that, in the original flowers, out of 2·632 per cent. of nitrogen, 0·65 existed in the form of amides and similar bodies. No starch could be detected, but abundance of sugar was present; the 46 per cent. entered under this head includes, however, some gum or mucilage. The potash and phosphoric acid in the ash were both high.

"The chief peculiarity of these flowers, from a dietetic point of view, is their richness in nitrogenous compounds. The ratio of albuminoids to the carbonaceous nutrients (translated into their equivalent of starch) is as 1 to 4·8. As the corresponding nutrient ratio in rice is as 1 : 10·8, it will be evident how desirable an addition they must prove to foods which are poor in nitrogen. And if we assume 16·7 per cent. of albuminoids to be present in *phog*, then this nutrient-ratio will come out still better, namely, 1 : 3·6, a proportion which corresponds pretty nearly to that in chickpeas. It should be added that there is rather close resemblance in composition between *phog* and the seeds of the edible amaranths and buckwheats, only sugar replaces starch.

CVII.—EARLIEST NOTICE OF COCA.

In the article on Coca in the January number of the *Kew Bulletin* it was stated that the earliest account in literature of the well-known Coca plant (*Erythroxylon Coca*) "appears to be that given by Nicholas "Monardes in the third part of his *Historica medicinal de los cosas* "*que se traen de neustras Indias occidentales que serven en medicina*, "which was published at Seville in 1580, after the author's death." According to Pritzel's *Thesauras*, two previous editions of the first two parts of this interesting and remarkable work were published in 1569 and 1574 respectively; both appear to be rare books, and are unfortunately wanting in the Kew library. The third edition, containing for the first time an additional third part, in which Coca is described, was published, according to Pritzel, by Fernando Diaz in Seville in 1580, and he calls this a posthumous edition.

The well-known botanist Dr. Ernst, Professor of Natural History in the University of Caracas, Venezuela, in a letter dated February 2nd, 1889, has obligingly pointed out the following grounds for believing that the account of Coca was published by Monardes in his lifetime, and at a somewhat earlier date :—

"With respect to Coca, I beg leave to point out that Monardes' description was first published in 1574 (Sevilla, by Escrivano). The edition of 1580 by Fernando Diaz is the second of the collected writings of Monardes. It is therefore not correct to say that this description was printed after its author's death. Monardes died 1588, as has been proved by Morejon (*Historia bibliografica de la medicina espanola*, Madrid, ii., 290). Meyer has taken from this source what he says about Monardes (*Geschichte der Botanik*, i., 412). The mistake about the year in which Monardes died comes from Antonio, who says in his

Bibliotheca hispana (Romæ, 1672, ii., 122; Matriti, 1783, ii., 154), what follows :—'Obiisse dicitur Octobris mense anno MDLXXXVIII. 'si credimus notulæ cuidam jamdiu scriptæ, ut ex characteribus 'pene evanescentibus apparet, in libri hujus *Medicinæ hispalensis* 'exemplari, quo utor: nisi deferendum sit magis tabulæ cujusdam 'altaris ad S. Leandri sanctimonalium Hispatensium, quæ Nicolaum 'Monardem anno MDLXXVIII. non obscure refert decessisse.'"

Colmeiro (*La Botanica y los botanicos de la peninsula hispano-lusitana*, Madrid, 1858, p. 28), remains in doubt as to which year should be adopted. But it is sufficiently plain from the edition of 1580 that Monardes was then still alive, for in the royal privilege (dated December 17, 1579,) he is addressed as living, and the printer's preface of this same edition ends with the wish that 'God may give a 'long life to him who by his science wishes to make long ours.' But if 1578 is therefore out of the question, 1588 is the only date to be adopted. Morejon (*l.c.*) refers to the documents of a law suit between the heirs of Monardes and one Nerozo, in which it is stated that Monardes was born about the year 1493, and died 1588, at the age of 95 years.

"There is another mistake on page 7 of the *Bulletin* (lines 8 and 9 from the bottom) instead of *Najas* (which means nothing), read *hojas*, *i.e.* leaves.

"Monardes is however not the first writer who mentions the *coca*. I have sent to the International Congress of Americanists, held at Berlin in October last year, a paper in French on the use of coca among some of the tribes in northern South America, in which I believe I have show nthat the *hayo* of Peter Martyr is the same as *Erythroxylon Coca*. His work was published in 1530, and he took the notice from the report of Fray Thomas Ortiz, who accompanied Alonso Nino and Luis Guerra in 1499 to the coast of Cumaná (Peter Martyr, Dec., vii., chapt. 6). Unfortunately some time will pass before my paper will be printed; but I shall send a copy to you as soon as I get one."

CVIII.—BUAZÉ FIBRE.

(*Securidaca longipedunculata*, Fres.)

In February of the present year Sir Villiers Lister, Under Secretary of State for Foreign Affairs, drew the attention of Kew to the fact that Mr. James Nicolls, of Mafeking on Lake Ngami, had in a report to the Colonial Office stated that "the Makouba tribe is famous for the "beautiful fish nets manufactured by them from the fibre of a species "of Cactus which grows in great abundance along the lakes and "rivers." The use of any cactus for the purpose seeming out of the question, application was made to the Colonial Office, asking if samples of the nets in question, together with specimens of the plant yielding the fibre from which the nets are made, could be obtained for the museum of the Royal Gardens.

The following correspondence gives the result of the inquiry:—

Cape Government to Colonial Office.

Government House, Cape Town,
April 27, 1889.

My Lord,

With reference to your Lordship's despatch No. 68 of the 4th ultimo, I have the honour to enclose, for your information, a copy of a letter which I have received from Mr. James Nicolls, forwarding a specimen of the fishing nets made by the natives living round Lake Ngami.

The net which accompanied Mr. Nicolls's letter has been forwarded by parcel post.

I have, &c.
(Signed) HERCULES ROBINSON,
Governor and High Commissioner.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

Mr. NICOLLS to Sir H. ROBINSON.

British Bechuanaland, Mafeking,
April 16, 1889.

YOUR EXCELLENCY,

I HAVE the honour to acknowledge the receipt through Sir Sidney Shippard of certain communications from Lord Knutsford and the Director of the Royal Gardens, Kew, in reference to fish nets made by the natives around Lake Ngami and mentioned by me in a report made for your information some time since.

I have much pleasure in now forwarding by post this day a specimen of the nets in question, and should feel happy if the authorities at Kew would be willing to accept some. The net I sent is the joint property of Mr. Robert Hicks of this place and myself. Some months since I sent a much finer specimen to Mrs. Nicolls, Belmont, Navan, county Meath, Ireland, and I have not the slightest doubt but that she would be only too willing to present same to the Royal Gardens, if application were made for it.

I beg to forward for information a short description of the plant from which the nets are manufactured.

I am, &c.
(Signed) JAS. A. NICOLLS.

The Right Hon. Sir Hercules G. Robinson, P.C., G.C.M.G.,
&c. &c. &c.

Enclosure.

FISH NETS from LAKE NGAMI and the BOTLETLE RIVER.

The fibrous plant from which the Makouba tribes make their nets is found very abundantly on the shores of Lake Ngami and on the Botletle, as far east as the point where the river bends directly southward. It flourishes in the dense shade afforded by forest trees on the margin of the lake and river banks, and is never discovered growing at at a distance of over 300 yards from the water. The plant itself, especially along the river, grows in impenetrable masses, attaining at most a height of about 5 feet. The stems, or, more properly, stalks, averaging about 1 inch in diameter, the points of such stems being furnished with a wonderfully sharp spear-like head. The fibre is rather thicker than that obtained from flax, and when freshly drawn from the stack very closely resembles fine fishing gut. In fact it has been most successfully used for angling purposes in the Botletle River. It can be fairly stated that the stalk, in the raw state, is fully as tough, if not tougher than a Manilla rope manufactured of the same thickness.

No criterion can possibly be arrived at as to the durability of this fibre from the specimen of net forwarded to the Royal Gardens, Kew, as the Makouba tribes do not take the slightest trouble in drying their nets after using them. It may be interesting to note that in the impenetrable thickets formed by the plant, that beautiful and rare specimen of the spotted bush buck of the Cholie and Botletle Rivers finds secure refuge from the attacks of man and wild beasts.

(Signed) JAMES NICOLLS.

Mafeking, 16th April 1889.

N.B.—Mr. Nicolls, on his return from Lake Ngami, at the close of the present year, will be most happy to furnish the authorities at Kew with specimens of the roots and stalk of the plant in question. At the same time he has to express his regret that, owing to the carelessness of the man in charge of his waggons, on his journey from Lake Ngami last year, the entire number of specimens of plants, &c., with very few exceptions, have been unfortunately lost.

From the description of the plant given by Mr. Nicolls, it was impossible to form any idea as to what its botanical affinity might be. Upon examinining the fibre, however, and comparing it with some nets from the same locality already contained in the Kew Museum, and made from the fibre of *Securidaca longipedunculata*, Fres., it was found to closely agree. The plant is a much branched divaricate shrub, sometimes growing to a height of 8 to 10 feet, belonging to the natural order *Polygaleæ*, and distributed through Upper and Lower Guinea, Nile land, Mozambique district, &c. Two kinds of fibre appear to be furnished by the plant; one from the bark of the twigs is very strong and durable, and would seem to be the fibre from which the nets are made, known in Zambesiland as Buáze fibre; the other from the stem, cross sections of which show layers of fibrous bark between layers of wood.

Buáze fibre seems to have been first introduced to notice by Dr. Livingstone in 1857. In his *Missionary Travels and Researches in South Africa*, published in that year, he says (p. 645) that he submitted a small quantity of the fibre to Messrs. Pye Brothers of London, who reported from 80, Lombard Street, under date 20th March 1857:—"The Buáze evidently possesses a very strong and fine "fibre, assimilating to flax in its character, but we believe when treated "in quantity by our process it would show both a stronger and finer "fibre than flax; but being unable to apply the rolling or pressing "processes with efficiency to so very small a quantity, the gums are "not yet so perfectly extracted as they would be nor the fibre opened "out to so fine a quality as it would then exhibit."

The opinion obtained by Messrs Pye, Brothers from Messrs. Marshall of Leeds was as follows:—"The Buáze fibre appears to resemble flax, "and as prepared by you will be equal to flax worth 50*l*. or 60*l*. per "ton, but we could hardly speak positively to the value unless we had "one cwt. or two cwt. to try on our machinery. However, we think "the result is promising and we hope further inquiry will be made as "to the probable supply of the material."

Dr. Livingstone adds that the plant is stated to grow in large quantities in the "Maravi country, north of the Zambesi, but it is not cultivated, "and that the only known use it has been put to is in making threads "on which the natives string their beads. Elsewhere the split tendons "of animals are employed for this purpose. This seems to be of equal "strength, for a firm thread of it feels like catgut in the hand, and "would rather cut the fingers than break."

Dr. Livingstone's original fragmentary specimen of the Buáze plant, which consisting merely of foliage was indeterminable at the time, exists in the Kew Herbarium. The botanical identification is due to Sir John Kirk, G.C.M.G., late Political Agent at Zanzibar, who during his attachment to the Livingstone South African expedition in 1859, and to the Zambesi Expedition in 1861, obtained an excellent series of specimens both in flower and fruit. The Buáze plant is well figured by Richard in his Tentamen Flora Abyssinicæ, t. 10, under the name of *Lophostylis angustifolia*, and by Klotzsch in Peters's Mozambique, t. 22, as *Lophostylis pallida*. Both names now give way to that at the head of this article.

Notwithstanding the comparatively favourable report on this fibre received so far back as 1857, nothing has since been done to further its utilization in this country.

CIX.—VEGETABLE PRODUCTIONS, CENTRAL CHINA.

There is no part of the northern hemisphere of which the flora has hitherto been so imperfectly known as the Chinese empire. The late well-known botanist Dr. Hance remarked in 1874:—"Whilst M. "Maximowicz's excellent and very complete *Index Floræ Pekinensis* "provides a good catalogue of the flora of the Chinese metropolis and "its vicinity, and Mr. Bentham's classical *Flora Hongkongensis* "has acquainted us with the principal constituents of that of the "extreme south-east of the empire, nothing whatever of a scientific "character has as yet to my knowledge been written on the vegetation "of the districts intermediate to these two points, which are separated "by 17 degrees of latitude, or of the various ports of trade along the "coast, or on the Yangtse."

In order to remedy this state of things the first step seemed to be to catalogue the notices of Chinese plants scattered through botanical literature and to enumerate in systematic order the species of which specimens collected by travellers in China were to be found in the Herbaria of the British Museum and of Kew. For this purpose a small Sub-Committee was appointed by the Government Grant Committee of the Royal Society (it has also received several grants of money from the British Association). The work was at once taken in hand at Kew, Mr. F. B. Forbes, F.L.S., who had long resided in China, having very generously placed in the hands of the Committee the manuscript collections which he had made with a similar object. As the catalogue has been compiled by Mr. W. B. Hemsley, F.R.S., Assistant for India in the Kew Herbarium, it has been set up in type and copies distributed to every European resident in China who was likely to be able to help. The Linnean Society assisted the work by publishing the *Index Floræ Sinensis* in its Journal and paying the cost of illustrations of the most interesting undescribed novelties. The result has been to stimulate an amount of activity in the exploration of the Chinese Flora which has far exceeded expectation. A profusion of collections of the greatest value and importance has poured in, and there is some risk that it may be difficult to compress the undertaking within the modest limits which were at first contemplated.

The first part was issued May 20, 1886. Two parts have been regularly published in each year since that date, and the seventh part, bringing the enumeration down to the *Loganiaceæ*, was issued April 30 last.

The work not merely brings to a focus all that it is accurately known about the natural vegetation of the Chinese empire; but it has the further convenience of serving as a catalogue of all the species of Chinese plants which up to the date of the appearance of each part were represented by specimens in the Herbaria of the Royal Gardens and of the British Museum.

To no one is the progress of the undertaking more indebted for the supply of copious and admirable material than to Dr. Augustine Henry, an officer of the Chinese Imperial Customs. Till 'the beginning of the present year he was stationed at Ichang on the Yang-tse-Kiang in the province of Hupeh, a position almost in the exact centre of China.

In the following letter Dr. Henry gives an interesting account of one of his more extended expeditions :—

MY DEAR SIR, Ichang, China, 9 October, 1888.

I HAVE just returned from my second trip, having been away about two-and-half months. I travelled due north from Ichang till I reached the range separating the basins of the Yangtze and Han rivers, and then I made my way along the range westwards as far as Szechuen, striking then the Yangtze on the Hupeh-Szechuen boundary line I returned two or three days ago by boat down the rapids.

I am now busy preparing a set of my collections of both trips, with those obtained by four natives working separately in three different localities. I consider it of importance to get these off as soon as possible so that they may be put into the *Index Floræ Sinensis*, the *Compositæ*, for example, will, I think prove, rich in novelties.

I reached at one point about 10,000 feet altitude, and found the mountains from 8,000 to 10,000 feet rich in plants not previously sent. The primeval forest still remains in parts, though sadly cut and burnt down by the cultivators of potatoes and the opuim poppy, the only crops grown. Many interesting conifers occur in this zone, one being a tall slender tree, perhaps 100 to 150 feet high, which originally clothed all the top of the range. Four *Ribes* also occur, one being an excellent gooseberry, a *Betula*, many Acers, curious *Rubi*, a *Fragaria* (like *vesca*), and some pretty Alpine plants. I also found what I take to be *Diphylleia Grayi*, an interesting addition to the Chinese flora. I also send many Roses and Viburnums. In these high regions many of the most important Chinese drugs occur of which the origin has been hitherto unknown. Rhubarb is dug up by the peasants. This *Rheum* is a tall handsome plant only occurring at above 8,000 feet in the wild state. In the mountains round Ichang I had hitherto only seen it cultivated, and that on a very small scale, one or two plants in the peasants' gardens. So far as I can judge the main source of the rhubarb exported to England is the range on which I was travelling, in its extent from N.W. of Ichang to the frontier of Thibet, along the boundary line between Szechuen and Shensi.

Huang lien (*Coptis Tecta*, Wall. ?) occurs cultivated. A rude staging about 400 feet by 400 feet is erected on the mountain side (6,000 feet to 9,000 feet altitude) composed of trunks and branches of trees driven into the ground, about 4 feet high, and across the tops of these poles other branches are laid horizontally, so that the sun will only glimmer on the plants growing beneath. After eight years' growth the root is large enough, and is then dug up and exported to all parts of China.

T'ang shên is another important drug, a member of the *Campanulaceæ*, a large twiner akin to *Codonopsis*.

I might mention many other drugs, but with the specimens I shall send ample memoranda descriptive of them. Of *Aconitum* and *Allium*

I have many species. Of an *Aralia*, like ginseng in habit, I have three or four varieties, which may be distinct species. This is known as *San-ch'i*, the name of a famous drug for use in wounds.

I had a very pleasant trip, being on excellent terms with the people. The *fauna* would also, I think, prove interesting, there being a very large antelope (nearly as big as a cow) with a white mane on the neck; two bears; wild boar; large monkeys; badgers, or animals resembling them, and several kinds of pheasants.

The so-called "wild cow" (***Budorces***), does not occur in this part of the range, but further west it is said to exist. The Chinese also speak of a "wild horse," described as being about the size of an ass, which formerly existed in this part of the range, and I have no doubt some animal of this kind (perhaps the origin of the "unicorn") will be found on the wilder parts of the range. We are trying to get a specimen of the splendid antelope alive to send to the Zoological Gardens, the skin which I bought being insufficient for scientific purposes.

No foreigner, not even the Roman Catholic missionaries, had ever been in these parts before; and not a single article of English manufacture was in use, foreign goods only being used as a rule by the better classes in towns and in the richer country districts.

I am, &c.
(Signed) AUGUSTINE HENRY.

CX.—VINE CULTIVATION IN THE GIRONDE.

In October 1881 the present Director of the Royal Gardens attended the International Congress at Bordeaux as representative of the Governments of New South Wales, South Australia, and Victoria. In the report upon the proceedings which was subsequently presented to these Governments, the opinion was expressed that, though various remedial measures had been proved to be efficacious in keeping the ravages of the Phylloxera under control, various practical difficulties, especially that of expense, would in the long run limit their applicability to vineyards producing wine of the highest quality. The problem of the continued existence of the general cultivation of the vine in France, and indeed in any country which has been infected with Phylloxera, seemed most likely to be solved by the use of American vines as stocks.

The following summary of the conclusions upon this point which were gathered from the deliberations of the Congress may be conveniently reproduced from the report which the Director made to the Governments he represented :—

"The Phylloxera and the American vines have grown up together in the New World. As the latter have not been exterminated, it follows that they have arrived at a mutual adjustment. The injury to the roots produced by the former, which in about eight years after the first attack destroys the vines in a European vineyard, the American vines are able to withstand and repair. I myself saw American vines growing in the Botanic Garden at Bordeaux to all outward appearance in perfect health, yet when the roots of these were exposed they were swarming with Phylloxeras. It is indeed believed that the invasion of France by the pest is due to the importation of American vines about 1862. The use of American vines in districts thoroughly infected with Phylloxera was eagerly supported by the vine-growers from the south, but was received with less favour by those of the west of France. The vines are used either as "direct producers," or as stocks on which European vines are grafted. The American vines which are in most favour as "direct producers" are the kinds called Jacquez and Herbemont; these are varieties of *Vitis æstivalis*, and the fruit is destitute of the "foxy" taste which is characteristic of varieties tracing their parentage to *Vitis Labrusca*. Branches of the Jacquez vine were shown laden with grapes in an extraordinary manner, and there can be no doubt that it is a vine of great fertility. Both Mr. Trimen [the representative of the Cape Government] and myself were at the pains on more than one occasion to taste numerous samples of wine made from both Jacquez and Herbemont grapes. To our taste these wines were far from palatable, being exceedingly acid, with a peculiar mawkish flavour. Of course they were very raw, but may improve after being kept for some time. Wine made from Jacquez grapes had evidently considerable body, and its extraordinary rich colour was immensely admired. That made from Herbemont grapes is said to be inferior in strength, but to have a more delicate flavour. It was supposed that these wines would, to a considerable extent, replace the coarser kinds of *vin ordinaire* and *vin du midi*, but my own impression was that the kind of merits which were most appreciated in them were those which would fit them for the processes of blending and mixing which now go on to such an immense extent in France.

"Both the Jacquez and Herbemont vines are put to a better use as stocks for grafting European vines. The Jacquez answers well for this purpose in the south, and its range of cultivation corresponds roughly with that of the olive. In the Bordeaux district it did not seem to do so well, and Herbemont is relied upon. The Riparia variety of *Vitis cordifolia* seemed, however, to be most in favour. The Bordeaux wine-growers viewed the whole question of American vines with the greatest impatience, while those from the south were quite enthusiastic about it. Some of the later discussions in the Congress assumed great animation in consequence, especially as the advocates and detractors of American vines seemed to belong to opposite political parties.

"For my own part, I have not the least doubt that the use of American vines, at any rate as stocks, affords the only chance of maintaining vine-cultivation in the future in Western Europe. There seems to be no apprehension that even in the case of vines producing the finest wines the influence of the stocks upon the grapes borne by the vines will be injurious. The only doubtful question was that of how far productiveness would be affected. Here the most opposite opinions were expressed. Some pointed to the generally received fact that grafting increases the productiveness of fruit trees, while others asserted that as a result of actual experience, the yield in the case of the vine is diminished. However this may be, it remained perfectly clear to my mind that when a vine-growing country has once become thoroughly infected with Phylloxera, and where submersion is impracticable, and the use of insecticides too costly, the employment of American vines, whether as direct producers or as stocks, is the only practicable mode of saving the industry."

It will be both useful and convenient to compare with these opinions expressed three years ago, the account given by H.M. Consul at Bordeaux in a report to the Foreign Office, dated March 15th of the present year, of the actual condition of the vine industry in the Gironde. It will be seen that while the actual cost of fighting the Phylloxera by means of insecticides in freshly infected vineyards has been immensely reduced and rendered practicable, where it would have been unremunerative eight years ago, the regeneration of vineyards in which the European vine had been extirpated by the Phylloxera has been effected, as was pointed out would probably be the case, by means of European vines grafted on American stocks. Direct production from American stocks has, fortunately for the wine consumer, been abandoned as hopeless.

"According to an estimate recently published the total area of vineyards under cultivation last year in the Gironde department was 349,817 acres; being an increase of 6,292 acres compared with the same period of the year 1887, in which latter year there had been a diminution in the acreage of wine-growing land as compared with 1886

"Though the figures showing the acreage of vineyards during 1888 are almost the largest ever reached and considerably larger than those attained about 10 years ago, it is necessary to observe that about one-half of the said 349,817 acres are still more or less infested with the *Phylloxera*; and it will thus be rendered evident that this destructive insect continues to do much havoc in the vineyards of this, as well as of most other parts of France. But it is nevertheless the opinion of experienced viticulturists in this country that, upon the whole, the prospects of the French wine-growers are looking brighter than they have done at any time since the appearance of the *Phylloxera* twelve years ago; it may be added that, as regards in particular the Gironde department, the outlook certainly must be called hopeful at present.

"For not only will doubtless the late abundant vintage give a fresh impulse to their energies and provide fresh means for the pockets of many proprietors who until lately have been hesitating or unable to employ the proper remedies for combating the *Phylloxera*, or recultivating their devastated land, but the fact, above referred to, that already last year there was a large increase in the annual extent of fresh plantations of vines, must be regarded as a favourable sign.

"These new plantations consisted almost exclusively of American vines, grafted with French plants of the best kind. Though this method of recultivation is more expensive than the direct production by American plants, it has to be resorted to in this district whenever purely French vines are not planted, inasmuch as the quality of wine obtained from American vines not grafted with French is of too inferior a description to be saleable here.

"A further reason for greater hopefulness amongst all interested in the wine trade and production of this district may be found in the circumstance that the measures now employed in combating the inroads not only of the *Phylloxera*, but also of all other cryptogamic diseases of the vines, are annually becoming more perfected, more known, and less expensive.

"The Agricultural Society of the Gironde recently published a statement showing the average costs incurred last year by proprietors in this department in employing the best known remedies, viz.: (1) against the *Phylloxera*, bisulphide of carbon; (2) against *Mildew*, the so-called 'Bouillie Bordelaise,' a mixture of 3 lbs. of sulphate of copper, with 1 lb. slaked lime and 22 gallons of water; (3) against *Oidium*, sulphur; and (4) against *Anthracnosis*, a mixture of 80 lbs. of sulphate of iron and 10 lbs. sulphate of copper. The total cost of using all these remedies is said to have amounted on an average to about 31*s*. per acre, an expense which cannot be called excessive, especially when it is added that their application served at the same time as a preventative against snails and slugs which also often do much damage to the vines.

"The employment of the so-called 'Bouillie Bordelaise' for preventing the vines from being attacked by mildew has become more and more extensive of late, in view of the successful results obtained; and many persons are of opinion that the abundance of the 1888 vintage was in a great measure due to the widespread use of this remedy in the vineyards of the Gironde. On the other hand, it must be mentioned that the use of the 'Bouillie Bordelaise,' a mixture (as above described) of sulphate of copper and slaked lime, has given rise to some apprehensions amongst the public at Bordeaux. For many persons cannot dispossess themselves of the view that the liquid in question—which is sprinkled upon the leaves of the vine—must have some effect upon the wine produced from the latter; and it is feared by them that not only may the flavour or other qualities of the wine be thereby possibly affected in an unfavourable manner, but that injurious effects may also arise therefrom for the health of the consumers. The sudden illness shortly after the end of last year's vintage of a large number of persons who had drunk wine known to have been produced in vineyards near Nimes, where the 'Bouillie Bordelaise' had been employed (an illness which was subsequently, however, proved to have been caused by other reasons), was at first ascribed in this and other parts of France to the noxious effects of the sulphate of copper contained in the mixture mentioned, and this added strength to the belief as to its dangerous qualities if employed against mildew. Though I have already on a former occasion taken the opportunity of dwelling upon this subject, it may, in the interest of the British consumer of Bordeaux wines, be again observed that many and carefully made analyses made here have fully proved that wines made from vines sprinkled with the 'Bouillie Bordelaise' are not injurious to health. For it has been repeatedly found that the quantity of copper contained in such wine does not exceed three-tenths of a milligramme per litre; or, in other words, a consumer before absorbing a maximum quantity of 45 grains of copper would have to drink at least 2,000 gallons of wine produced from such vines. According to scientific experiments this trifling amount of copper is in fact not greater and probably less, than the per-centage thereof contained in some other articles of daily food which are admitted into the human body without injurious or unpleasant effects. How far, on the other hand, the use of the 'Bouillie Bordelaise' may have already affected, or will affect, the flavour and some other qualities of the wine derived from vines sprinkled with it, is a question which to my knowledge has not yet been definitely settled."

CXI.—PHYLLOXERA IN SOUTH AFRICA.

At the time of the International Phylloxera Congress at Bordeaux in October 1881 there was no evidence to prove that the Phylloxera had invaded South Africa. Mr. Roland Trimen, F.R.S., F.Z.S., Director of the South African Museum, was, however, delegated as representative of the Government of the Cape to the Colony, and he reported upon its proceedings December 29, 1881. In the 25th paragraph of his report, after having fully discussed the matter with the late Professor Planchon, the most eminent authority on the subject at the time, he stated:—

"I am entirely in favour of reasonable precautionary measures, and I think that those which Professor Planchon recommends are fully sufficient. The total exclusion of all vines should be maintained; the admission of all other plants from countries where Phylloxera in the vine does not exist should be allowed; and the admission of plants other than vines from phylloxerized regions should be conditional as satifactory certification that they have not been grown in the immediate vicinity of vines."

It can hardly be doubted that had it been possible from the first to enforce such regulations efficiently, South Africa would have remained free from the ravages of the Phylloxera. Nevertheless, it appears from the evidence of Mr. Louis Peringuey before the Select Committee of the Cape House of Assembly on the Vineyards Diseases Act (presented with their report, July 29 of the present year) that the insect was first identified by him in South Africa on January 1, 1886. "It came from Kotze's at Mowbray." [Qs. 936 and 937.] This is in the neighbourhood of Cape Town.

The infection of the Cape vineyards is now unhappily thoroughly established. The Cape Government have, however, done the only thing possible, and have obtained the assistance of a most competent authority to advise them in M. P. Mouillefert, Professor of Viticulture in the French National School of Agriculture, Grignon. The following able "Report upon the Vineyards of the Cape Colony" is reproduced from the *Agricultural Journal*, published by the Department of Agriculture of the Cape Colony for May 2, 1889. Treating as it does of so important a cultural industry in one of our principal colonies, it will be conveniently made accessible for wider reference in the pages of the *Kew Bulletin*:—

"Sir, "Cape Town, 30th March 1889.

Having been deputed by the French Government, in accordance with your request, to come and inspect the vineyards of the Cape Colony, as regards their protection from the Phylloxera, I entered upon this duty immediately after my arrival. In company with Professor Fischer, the Secretary for Agriculture, and M. Peringuey, Inspector of Vineyards, I visited the principal wine-farming centres, and now have the honour of submitting to you the observations I have made, and the conclusions to be drawn therefrom.

"Although the existence of the Phylloxera in the vineyards of the Colony was not verified officially before the year 1886, the disease is, in my opinion, of much earlier date, and in accordance with Mons. Peringuey, who has made a special study of the question, I consider that the invasion of this destructive insect should be approximately fixed at about the year 1880.

"I shall say nothing respecting its introduction into the Colony. That seems to be a question which will never be definitely decided. On the other hand, I had no difficulty in observing that the Phylloxera, as was to be expected, had run the same course here as in Europe, that its peculiarities have been the same, and that its effect upon the vine has been identical; all these data being well understood. But there is this very important difference, that, owing to the mildness of the climate of the Cape, there is, all the year through, no check to its reproductive powers, and consequently its increase is far more rapid than in Europe. It has also been ascertained that the production of winged females, whose special function is the wide dispersion of the species, lasts for a much longer time here than in the northern hemisphere, that is to say, for nearly four months; while in France such production is spread over no more than eight or ten weeks. It is recognised, also, that the mildness of the climate and the great heat of the summer, far from checking the parasite, actually favour it. Hence the defensive position of the vine in the colony is decidedly inferior to that which it holds in colder climates where the soil is not so dry during the period of vegetation.

"The mischief having been once clearly ascertained, what action should be taken in the matter? It was obviously reasonable to follow the method adopted in France, where the problem has been studied these twenty years past by men who, from a scientific point of view, are thoroughly competent and whose labours are well known. This wise course has been chosen instead of delaying action by the repetition of studies already worked out, and experiments made long ago, and upon which definite conclusions have been founded already.

"It was prudent also, to take count of the local conditions, which are very different here from those existing in France. There wine farmers are of old date, and well supplied with cultural appliances which are out of the reach of the Cape Viticulturist. Hence it follows that remedial measures of proved efficacy in Europe, such as submersion, the employment of bisulphide of carbon, and the alkaline sulpho-carbonates, could not be universally applied here. The same thing may be said of the reproduction of the vines upon American stocks, a method which requires a staff of experts for the operation of grafting, the most careful attention and considerable outlay, and even then with no absolute certainty of success. Nevertheless, I have been gratified to observe that the Cape Government has in this direction had the foresight to establish, by means of seedlings, a nursery of phylloxera-proof stocks, which may be turned to account when needed.

"But all the measures hitherto indicated do no more than establish a *modus vivendi* between the vine and its enemy, without completely exterminating the latter. Hence follows the necessity of destroying the insect outright, if possible, by the extinction of its original centre of production—in a word, by destroying all contaminated growth.

"In France this drastic mode of procedure, proposed in 1873 by the Phylloxera Commission, unfortunately could not be carried out. It was already too late. The mischief was too widely spread, and no one at that time put into practice the methods of destruction and disinfecting the soil which have subsequently had their trial.

"But in Switzerland, and also in Algeria, this procedure, recommended by the Commission in 1873, had been eminently successful, although in the latter country its application was merely tentative. Not only is the progress of the plague arrested by the uprooting of the original centres of production after the insect has been destroyed, but a stop is put to the numerous winged swarms which would proceed from the infected stocks, and would for several years continue to proceed from thence, to found at a distance new colonies, in numbers ever increasing, like the terms of a geometrical series. So rapid is this progression, that the original point of infection in the south of France spread in six years over an area of 30,000 hectares (= 37,500 Cape morgen) and in ten years had covered 15,000,000 hectares (= 10 million Cape morgen). The inevitable result has been a period of enormous disaster. The average production of wine has decreased by upwards of 20,000,000 of hectolitres (= nearly 3,000,000 leaguers) and this means a loss in money value of more than 1,000,000,000 francs, without taking into consideration the depreciation in the value of viticultural property consequent upon the failure of returns.

"In the Cape Colony, the Government, warned by the foregoing facts, has, to its great credit, promptly entered into the contest upon the only satisfactory basis. The manner in which that struggle has been carried on reflects great credit on the Phylloxera Commission, and especially on M. Peringuey, to whom has been allotted the duty of practically carrying out the method adopted—a method of which he has been a most ardent advocate, and one which he has not shrunk from applying to an extent hitherto unknown in any country, regardless of the risk of personal unpopularity.

"Considering that the vineyards of the Colony are sufficiently isolated from each other, there was all the more reason to follow this line of procedure, particularly as there exists no neighbouring nations by whose instrumentality the pest might hereafter be re-introduced. The expenditure incurred in this contest has necessarily been considerable, but, when the results achieved are compared with the cost, it will be easy to show that the measures taken have been consistent with the best interests of the wine-farming proprietary and of the colony generally, while the Parliament and the Government cannot be too highly congratulated upon what has been effected.

"In point of fact, the area of this phylloxeric invasion either actually extends over, or threatens, about 70,000,000 vinestocks, the extent of 10,000 hectares (12,500 morgen) of land. According to the last official statistics, these produce on an average 5,119,608 gallons (=40,312 leaguers) of wine, having a mean annual value of 131,952*l.*; and 10,945 leaguers of brandy, worth 164,175*l.*; besides about 200,000 lbs. of raisins, valued at 2,500*l.*, giving altogether a total of 298,627*l.* Including sundry accessory products, the output may be stated as not less than 300,000*l.* sterling per annum.

"Hence, with a full knowledge of what has been experienced in France, and keeping in view that the climate of the Cape is, in comparison, even more favourable to the spread of the disease, it may be affirmed that, but for the energetic measures of repression which have been taken, *the vineyards situated in the aforesaid area would by this time have ceased to exist, or would be compromised to the last degree, and with them the entire wine-district of the Colony.*

"Now, if the results obtained be balanced against the expenditure incurred, it will incontestably appear that the action taken has been of the highest advantage to the country. The average annual returns of the vineyards threatened with destruction exceed by thirty-fold* the expenses disbursed in the whole three years of anti-phylloxeric treatment, while the productive capital stock has been preserved almost in its entirety.

"Nevertheless, considering the outlay inevitable in the contest, a prudent Government might reasonably put the question whether it is advantageous to continue such expenditure, or whether it would not be preferable to leave to the wine farmers themselves the option of defending or not defending their vineyards. But, under the latter alternative, would there not be good reason to fear that the colonial wine farmer, if left to his own resources, would make no effort to save his property from destruction? And if this unfortunate result should follow, as one may well believe it would, a great disaster would assuredly befall the Colony, seeing that the well-being of the whole community is indissolubly bound up in that of the individual.

"It is on these grounds that I have no hesitation in declaring that it will be to the interest of the entire Colony that the Government should persevere in maintaining the hand-to-hand contest with the enemy which it has hitherto done with so much success. By pursuing this

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[*] The value of the total yield for three years 900,000*l.* in comparison with the expenditure during the same period on anti-phylloxeric treatment.

course, not only will the actual extirpation of the plague be within the bounds of possibility, but there will be the certainty, supposing only the minimum results be attained, of so thoroughly checking its advance, that the future annual expenditure charged upon the country will be but a small fraction of the pecuniary interests protected. Such outlay will be a sort of premium of insurance against the evil, guaranteeing to the Colony a yearly income of 300,000*l.*, which represents a capital stock of certainly not less than 3,000,000*l.* sterling. And it may be further pointed out that the market value of landed property in the wine-producing districts depends not so much on the number of morgen as upon the number of vines it will carry.

"Add to all this that the struggle will be all the more easy of maintenance, since the Phylloxera Service has been in every respect well organised, thanks to the zeal, energy, and great ability of M. Peringuey; the expenditure for tools and appliances used in the distribution of the bisulphide of carbon has already been made; the staff employed in extirpation and inspection (and I have seen it at work) is well trained and reliable. All these circumstances combined admit of the work being carried on henceforth with great economy, and at the same time under the best conditions for securing efficiency.

"Be it understood, however, that if the method pursued is to give all the results of which it is capable, there must be the power to apply it with a free hand in every case where it is deemed necessary. There must be no hesitation in applying, as it were, the actual cautery to the wound, and in enlarging the protective zones, especially in the direction of the boundaries of the phylloxeric invasion.

"The staff employed in inspection occupies a highly responsible position, for on it, to a large extent, depends the success of the operations. Independently of the careful examination of all vine stocks in regular routine, the head of the staff should find means of ensuring a still more exact scrutiny of all suspected localities, as well as of the vines in the neighbourhood of those that have been pronounced affected.

"I have been pleased to observe that this is being done, and that M. Peringuey's instructions were perfectly understood. It is scarcely necessary to say that it is of the greatest importance that the visitation of the vineyards should take place each year, as is the rule elsewhere, before the swarming season of the Phylloxera, and the same precaution holds good with regard to measures of eradication.

"Turning to another aspect of the question, the permission to replant a destroyed vineyard after the lapse of a specified time, is a matter of great moment. The length of this period will, of course, vary according to circumstances, specially with regard to the distance from other vineyards, the aspect, the situation, and the sort of culture which has followed the eradication. I think that, in general, the replanting may be permitted after three or four years' fallowing, if the spot to be replanted is situated not less than 10 to 12 kilometres (6 or 7 miles) from the nearest phylloxerized area. To this end I think it would be well if the Government had nurseries of the best sorts of vine plants established in perfectly uninfected localities, and were to arrange that these plants be delivered on stated conditions to such proprietors as might wish to establish vineyards either in unphylloxerized districts, or to replant those which had previously been destroyed in the common interest.

"It appears to me that, with this combination of measures, the end aimed at may be attained in a manner advantageous to the wine farmers, and in accordance with the best interests of the country, and for this it is only necessary to persevere in the course which has fortunately been adopted.

"I take leave in this report to call the attention of landed proprietors in the viticultural districts to certain points in the management of their vines, and above all to the manufacture of the wine itself. Speaking generally, I have found the wines of the Cape possessed of qualities of a remarkable and even unique kind, which, if they were known, would cause them to be appreciated all over the world. But, such as they are, that is to say, possessed of great alcoholic strength, they certainly are best fitted for consumption in the comparatively cold regions of Europe and America, nor does it seem to me impossible to cause them to be appreciated at their true value in those countries. On the other hand, for places where the temperature is somewhat high, and for the Colony itself, the wines of the Cape are far too heating. They can only be partaken of in small quantities, and therefore are not sufficiently refreshing. The consequence is that other beverages are preferred, notwithstanding their high price and inferior intrinsic value. If Cape wines could be prepared with a uniform strength of 11° to 12° only, instead of 18° to 22° as is now done, I doubt not that we should witness a rapid rise in the average consumption, and this would tend, as a natural result, to a considerable increase of the output, and give a very decided impulse to the colonial wine industry.

"Such a state of things is, I think, quite attainable. It will be necessary, in the first place, to compel the vines to carry a heavier crop by allowing a greater length to the bearing shoots, or by arranging from the first to have stocks of a considerably greater height. Secondly, the gathering must take place earlier than is usual, that is to say, at a stage when the grapes are less ripe or even somewhat acid. Thirdly, the fermenting house must be cooler, a condition to be attained by constructing the basement partially underground, building thicker walls and more substantial roof cover, as a protection against high temperature. Fourthly, close fermentation, carried on in casks, not in open tubs, and also apart from the husks, is essential. It is with satisfaction that I have observed these methods already in use at the viticulturist school at Constantia, as well as in several private establishments, a beginning which will be fruitful of good results. The samples of their production which I have tasted incontestably prove the possibility of making in the Colony excellent wine of low alcoholic percentage.

"It has also struck me that many vineyards are not producing as much as may reasonably be expected of them, having regard to the growth on the stocks and the depth of the soil. I think that under these circumstances a top-dressing of lime, in some form or other, with an addition of phosphates, would considerably augment the returns, At Robertson and Montagu, where the vines (on a calcareous soil) are duly manured and irrigated, it is easy to obtain a return of twenty leaguers per morgen, whereas at Paarl only seven or eight leaguers are obtained, and at Stellenbosch not more than three or four is the average

"These are the views, sir, which I find myself able to report in all frankness upon the subject of the honourable mission which has been confided to me, and it will afford me great gratification if my humble words gain attention, and are found to be of service to the highly important interests of colonial viticulture.

"I have, &c.

"P. MOUILLEFERT."

CXII.—ERRONEOUS REPORT OF PHYLLOXERA IN GREECE.

The Foreign Office has communicated to this establishment the following despatch from the British Minister at Athens denying the correctness of the reported appearance of Phylloxera in the Morea. The appearance of the insect in Asia Minor was recorded in the *Kew Bulletin* for March of the present year and its further possible extension in the Eastern Mediterranean cannot but be a ground for the gravest anxiety.

SIR E. MONSON to the MARQUIS of SALISBURY, K.G., &c. &c.

MY LORD, Athens, 23 August 1889.

THE "Times" of the 19th instant having published a telegram from its correspondent at Rome stating that Phylloxera had made its appearance in the Morea, M. Gennadius telegraphed to his Government asking if this were true.

He was instructed to make public at once the most categorical denial of the truth of the report.

Mr. Consul Wood, of Patras, has sent me an official despatch asserting that there is no Phylloxera in the Morea; and M. Dragoumis, in mentioning the matter to me to-day, said that he presumed that the report had arisen from the fact that a vine cultivator near Patras had recently requested the Government to send an expert to look at his vines, which he feared were unhealthy; and that the specialist despatched by the Government had reported that though sickly the vines were perfectly free from the dreaded disease.

I have, &c.
(Signed) EDMUND MONSON.

The Marquis of Salisbury, K.G.,
&c., &c., &c.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 34.] OCTOBER. [1889.

CXIII.—BAHIA PIASSAVA.

(*Attalea funifera*, Mart.)

A valuable fibre, largely used in this country under the name of Bahia Piassava, is obtained from the leaf-stalks of a Brazilian palm known as *Attalea funifera*, Mart. This palm has a wide distribution in the lowlands of Brazil, and is found throughout the province of Bahia, parallel to the coast, from San Salvador or Bahia in lat. 13° to Caravellas in about lat. 18°.

Para Piassava, which is exported from the port of that name, is slightly different in texture and colour from Bahia Piassava, and is derived from another palm, *Leopoldinia Piassaba*, Wallace. Specimens of both Bahia and Para Piassava, together with appliances used in the industry, as well as finished articles, are shown in the Kew Museum No. II. The excellent series of Bahia Piassava is shown in Case No. 62. One of the earliest notices of Bahia Piassava, and probably the first where the plant yielding it is authoritatively determined, is contained in an article in Hooker's *Journal of Botany and Kew Garden Miscellany*, vol. i. (1849), pp. 121–123. In this notice Sir Wm. Hooker states :—

" Few have walked the streets of London without remarking that of " late years those streets are, in places at least, kept peculiarly neat

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1889.

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" and clean by the stiff fibres of a new material for making brushes " and brooms; those of the machines, as well as those employed by " hand; and if anyone is asked what be the origin of this fibre, the " frequent reply is, 'Whalebone, I suppose.' But, no; it is not of " animal but vegetable origin, the coarse fibre of a species of palm " (*Attalea funifera*) which grows abundantly in Brazil. This curious " material, according to its stoutness and tenacity, is employed for " cordage and mats as well as for brooms and brushes. The dilated " base of the leaf-stalks separates into a long coarse fringe, which is " collected by the natives and used in the country or exported to " Europe for the purposes above mentioned, and now constitutes a " considerable article of commerce.

" The fruit or nuts of this palm are another article of commerce, " long brought into England under the name of *Coquilla nuts*, and " extensively used for various kinds of turnery-work, especially in " making handles of bell-pulls, umbrellas, &c., &c.; for the shell (or " putamen) is of great thickness, excessively hard, beautifully mottled " with dark and light brown, and capable of taking a high degree of " polish."

As far as we are aware, no detailed account of Bahia Piassava has been published in an accessible form. We are therefore happy to avail ourselves of the courtesy of Mr. W. S. Booth, Belle Vue House, Gloucester, who has prepared from personal observation the following excellent account of the present condition of the industry in Brazil for the *Kew Bulletin* :—

" The fibre of this palm (*Attalea funifera*) is obtained chiefly in the province of Bahia, along the coast south of Valença, where the supply is now exhausted, to Porto Seguro, which will soon be in the same condition.

" Throughout this tract Piassava is found growing scattered in the woodland (Piassava do Mato), and in some places in extensive patches, called campos, nestling in the heart of immense virgin forests.

" Naturally, the 'Piassava do Campo' is more easily obtained than the 'Piassava do Mato;' for while the former grows in spots where it is only interspersed among ferns, it is often necessary to traverse a large tract of country to come upon a sufficient quantity of the latter. Moreover, a certain 'pratique' is required to discover the isolated trees at first sight in the dense tangle of a tropical jungle.

" Piassava of either denomination is divided, according to its age, into two kinds, viz., Bananeira and Coqueira.

" Bananeiras, or young plants, whose trunks are not yet developed, and which yield a fresh coloured and supple fibre.

" Coqueiras, or fully developed plants, yielding two or three qualities of fibre, according to its age; viz. :—

(1.) Ordinary fibre, which is found wound up among the broken leaves, and the upper part of the trunk.

(2.) Balloon, formed by the older fibre which has fallen to the ground round the base of the trunk.

(3.) Piassava d'olho, or " eye Piassava," which is the latest growth, and is in all respects similar to that yielded by the 'Bananeiras.'

" The Piassava d'olho, by reason of its flexibility and colour, is used chiefly for tieing up and embellishing the bales. Its yield is always small, being about 15 to 17 per cent. of the total 'pul' of the tree, which is from 3½ to 5 arrobas (1 arroba = $32\frac{1}{3}$ lbs.) on a fully grown tree.

"This palm grows in the neighbourhood of rivers, and on land that is always in a half swampy condition, being below the flood mark in the rainy season. 'They are erect trees, terminated by a crown of large 'pinnatisect leaves (between which the spathes appear); flowers, 'yellowish, succeeded by ovate or elliptical fruits (drupes), of a brown 'or greenish brown colour.' The hard thick shell of the nut contains two oleaginous edible seeds, and is enclosed in a thin polished fibrous case which is capped at the base like the acorn. The campos, as a rule are not liable to flood, but lying as they do surrounded by swampy land, the conditions of moisture are fulfilled, in which it is necessary for the trees to flourish. The mean temperature of the Piassava district is about 77° F. On reaching the age of six to nine years, the palm begins to bear fibre fit to pull. The present mode of obtaining it is to cut the tree down, and pull the fibre from the trunk afterwards, a very foolish proceeding, considering the time the fallen nuts take to germinate and grow into bearing trees. The base of the petiole of the leaf wraps round the trunk (as can be seen in many other palms) like a sort of fibrous wrapper which splits in the course of the trunk's growth, and falls over on either side. The petiole contains two transverse layers of fibre, the one going up into the midrib of the leaf, and the other to form the wrapper, both protruding in a festooning fringe from the edge of the petiole.

"From this it will be seen that the fineness or coarseness of the fibre depends largely on its position in the petiole, the coarsest fibre lying closest to the midrib.

"*Two commercial kinds of Piassava.*

"There are two kinds of Piassava used in commerce; the round, stiffish fibre from the districts I have mentioned, which is shipped from Bahia, and known as 'Bahia Piassava (*Attalea funifera*); and that collected on the Amazons and the Rio Negro, shipped from Manáos, and Pará, and known as 'Pará Piassava' (*Leopoldinia Piassava*, Wallace, Palm trees of the Amazon, p. 17). This latter is flat, soft, and flexible, altogether differing from 'Bahia' fibre, and commanding on occasions three times its price, which at present stands at 38*l.* for good red fibre.

"In Brazil, these fibres are used for cables, ropes, baskets, hats, tieing, fences, and many other purposes; but in this country, and in Europe, solely for brush and broom work, by itself and mixed with other fibres.

"The nuts of the Piassava are exported to Europe for the manufacture of buttons, knobs, &c.

"*Method of Collection and Preparation for the Market.*

"Immediately after the exploration (often very arduous) undertaken to discover crops which will repay the cutting, it is necessary to establish the 'camp,' and to stock it with food and implements indispensable to the men; also to find a pasturage for the animals employed, and a supply of fodder to augment the unsubstantial food that is yielded by the forest. Through failing to take this precaution, the best troops of mules will be reduced in a few months, and the number of sick animals will be considerable; to say nothing of the difficulties which will follow from this false economy.

"As soon as the cutters have arrived in the camp, each takes a different direction, thus endeavouring to secure an advantageous cutting

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position, from which, when found, he does his utmost to keep his companions.

"The weighing of the pulled Piassava should be done every fortnight, as the men are furnished on credit at the 'barracão,' and it is well to settle their accounts by weighing their work fortnightly, or so.

"The average cut of one man per diem may be estimated at three arrobas (1 arroba = 32⅓ lbs.) of loose, *i.e.* unbound Piassava; and the amount of his credit should be based on this quantity. It must be borne in mind that these cutters are not only great hunters, so wasting a day from time to time in the pursuit of game, but they are lazy, and could they obtain unlimited supplies on credit, they would not scruple to abuse such credit on all occasions.

"Though I have estimated the daily work of one man at three arrobas, an inexperienced hand is often unable to clear more than one or two; while on the other hand a very hard worker has been known to clear as much as six arrobas in one day. It is customary to weigh the fibre only in cabeças; that is to say, after it has been made up into the small bundles of which a bale is composed; though, in my opinion, the Piassava thus weighed is much more favourable to fraud than that weighed unbound.

"It may be useful to note here that the cost of binding up the cabeças is 20 reis a-piece (1,000 reis = 27*d.*).

"As limited above, the cutters always do their best to defraud the principals or buyers. They smuggle stones, and pieces of palm inside the mondongas (*i.e.* parcels supposed to weigh 60 kilos or 132 lbs., ready for weighing); they spread the fibre out on the ground, leaving it a long time exposed to the rain; and finally, their shanties being always built by the side of running water, they think nothing of sinking the 'cabeças' in these streams 'end on', so that they may be impregnated with the fine sand brought down by the current. As a 'set off' to this treatment, the buyers are not slow to imitate these edifying examples; they cause their weighing machines to be tampered with before being used, and they allow errors to creep into their accounts, which never result to their own disadvantage.

"As soon as the fibre is weighed, the proprietor sends it down to his fazenda by the mules. The main track is cleared at the expense of the owner of the cutting, and the cutters are obliged to have their fibre weighed on this path, or make a road themselves to the place where they have built their shanty. The mules are usually driven in troops of seven animals to each muleteer, and the weight carried by each mule is six arrobas (194 lbs.)

"Upon arrival at the fazenda the fibre is unfastened, cleaned, and pressed into bales by a packing press, or by hand.

"It is packed into two kinds of bales; viz.—the molho and the fardo.

"The molho is pressed by hand, it contains three or five cabeças, and is bound in five, seven, or nine places. The charge for making these up is 200 reis (5⅜*d.*)

"The fardo contains 10 or 12 cabeças and by reason of its size is packed in the press; costing from 240 to 300 reis per fardo for making up. A good packer will turn out from 18 to 22 molhos daily, and two good workmen can press from 30 to 40 fardos in the same time.

"If the fazenda be on a river the goods are shipped down to the coast town by canoe; a large one holding say 45 to 50 fardos, or about 120 to 130 molhos.

"With very small exceptions for local uses, the whole of the fibre pulled is sent to Bahia to be sold on account of the owners by the consignees.

"The annual export is about 7,000 tons, of which Great Britain takes slightly more than half; Germany coming second with nearly a quarter; while Belguim, France, Portugal, and the Southern Republics together, take the remaining quarter.

"There is an export duty, imperial and provincial together, of 20 per cent. *ad valorem*, which is declared every week, and is assessed on the average weekly prices of the sales made by the brokers.

"Taking into consideration the simplicity of its production (the fibre being ready for the market the moment it is pulled from the tree, and baled), the heavy duty in Brazil, and the high prices realized in Europe, I cannot help thinking that those interested in the development of profitable industries in India, and our other tropical possessions, would find an attempt to transplant the Piassava Palm rewarded ultimately by handsome returns.

"I am greatly indebted to Mr. E. F. Bradley of the Star Brush Company, Holloway, and to Senr. F. E. Blanchet, of the Fazenda Bolandeira, near Canavieiras, for much valuable aid in this inquiry.

" *Appendix.*

"Export returns of Piassava fibre from Bahia for the year ending January 1889:—

Great Britain - -	535,419	
Germany - - -	289,548	
Belguim - - -	91,385	
France - - -	80,123	
Portugal - - -	36,247	
Argentines - -	5,730	
Uraquay - - -	5,706	
Spain - - -	1,018	
Austria - - -	727	
	1,045,903	milreis at 27*d.* £117,664.

"Two hundred and fifty milreis is payable annually to the Provincial Government for the right of cutting not more than 60,000 arrobas (say 28*l.* 2*s.* 6*d.* for 866 tons). Athough 866 tons be the amount specified on the licence, the proprietor is always well satisfied with 100 tons, and rarely gets more from one camp of cutters.

"I append a first-cast account as it may be of some interest or service. I have not taken into consideration the cost of opening up paths through the forest, as this outlay is a very uncertain amount, depending entirely on the character of the obstacles.

" *Cost per Arroba* ($32\frac{1}{3}$ *lbs*) *in Bahia.*

Paid to cutters (say)	800
Loss in weight (stones, water, &c.)	80
Licence	40
Legitimization before shipment	7
Hire of animals	666
Wages of muleteers	90
Packing and labour	75
Transport to coast town (say)	150
Wear and tear of materials and implements	35
Municipal taxes at coast town (say)	40
Food for animals, corn, &c.	100
Freight to Bahia	260
Commission and Insurance 5 °/o on 2,500	125
Milreis	2,468

" Taking a milreis as worth 27*d.* this gives 5*s.* 7*d.* in Bahia."

CXIV.—SEEDLINGS OF SUGAR CANE AT BARBADOS.

(*Saccharum officinarum.*)

In the *Kew Bulletin* for December 1887 (p. 294), an account was given of the occurrence of what were believed to be seedlings of sugar cane at the Botanical Station, Dodd's Reformatory, Barbados. Hitherto, the sugar cane under cultivation has so rarely produced mature seed that it was generally believed that it had entirely lost the power of doing so. In a few special instances, what were believed to be seedling sugar canes had been observed at Barbados and elsewhere, but they were not successfully raised, and the subject had practically fallen out of notice, until it was revived by Professor Harrison and Mr. Bovell, in connexion with the cultural and chemical experiments so successfully carried on by them for some years at Barbados.

Since the publication of the note in the *Kew Bulletin*, considerable interest has been taken in the subject, and several new facts ascertained. As it is very desirable, in the interest of the important sugar industry, to obtain improved varieties of the sugar cane, the following letter has been addressed to the Colonial Office, containing suggestions respecting the further treatment of the seedling sugar canes at Barbados, and of any that may be found in other sugar producing colonies in the West Indies:—

"ROYAL GARDENS, KEW, to COLONIAL OFFICE.

" SIR, Royal Gardens, Kew, 9 August 1889.

" WITH reference to your letter of the 8th December 1885, and subsequent correspondence on the subject of the improvement of the sugar cane in the West India colonies, I am desired by Mr. Thiselton Dyer to forward, for the information of the Secretary of State, some of the results which have lately been obtained in furtherance of this object.

" 2. It will be within your recollection that in my letter of the 12th May 1886, extracts from which were circulated by the Colonial

“ Office for the information of sugar-producing colonies, it was suggested
“ that the attention of botanists and sugar planters in such colonies
“ should be directed to any variations appearing accidentally in the
“ cane-fields, and that canes exhibiting such variations should be
“ carefully cultivated with the view of testing their value.

“ 3. The circulation of these and other suggestions from Kew has
“ apparently been the means of directing attention to the possibility of
“ securing new varieties of sugar canes, and of generally improving
“ their yield in crystallisable sugar. Indeed, the correspondence
“ received at this establishment has shown that the subject has received
“ attention in such widely remote colonies as Fiji, Queensland, and
“ Mauritius, as well as in the West India Islands and British Guiana.

“ 4. At Barbados, a series of very interesting investigations has been
“ carried on for the last four years at the botanical station of the colony,
“ under the direction of Professor Harrison and Mr. Bovell. These
“ investigations, supported by the intelligent action of the local govern-
“ ment, were, in the first instance, confined to trials of various canes
“ introduced to the West Indies by the botanical establishments of
“ Jamaica, Trinidad, and British Guiana, and to the yield of these as
“ compared with the yield of canes already known in the island. The
“ experiments were also directed to test in an exhaustive manner the
“ relative value of various manures, and to determine under what con-
“ ditions such manures were found to yield the best results.

“ 5. A summary of the conclusions arrived at in these investigations
“ has been regularly published by order of the House of Assembly of
“ Barbados, and it is needless to refer to them here in detail.

“ 6. These investigations, however, possess a special interest, because
“ in connexion with them a fact has been observed which it is hoped
“ will have an important bearing upon the ultimate improvement of
“ the sugar cane. It has been shown with some probability by
“ Messrs. Harrison and Bovell, that under certain circumstances it is
“ possible to raise sugar cane from seed, an occurrence, owing to its
“ extreme rareness, about which there has been so much doubt that it
“ has been thought impossible.

“ 7. The first announcement respecting the probability of sugar
“ canes having been raised from seed at the Barbados Botanical
“ Station was made in the *Kew Bulletin* for December last. Since
“ that time further information has been received which appears to
“ show conclusively that certain varieties of sugar canes still retain
“ the power of producing mature seed. From a botanical point of view
“ this is sufficiently interesting to require more than a passing notice.
“ From the point of view of the sugar planter it is a fact which if
“ established and intelligently followed up is capable of effecting as
“ much improvement in the sugar cane and in its yield in sugar as has
“ been effected in the beet. For the first time it has been shown that
“ it may be possible to pursue such a system of selection by seminal
“ reproduction in the case of the sugar cane as to greatly increase its
“ value as an industrial plant.

“ 8. The economic bearing of the discovery of seedling sugar canes
“ at Barbados will, however, depend very much upon the means taken
“ to utilize it to the best advantage. At present Mr. Thiselton Dyer
“ is of opinion that Messrs. Harrison and Bovell should be encouraged
“ to devote special attention to the subject of seedling sugar canes,
“ especially in testing the richness in sugar of the various seedling
“ canes already established by them. It is hoped that the government
“ of Barbados, to whom great credit is due for the results already

" obtained, will, in view of the importance of the subject, be disposed " to support these investigations by such funds as are necessary for " the purpose in view.

" 9. Now that the fact that certain varieties of sugar canes may " produce mature seed appears to be available for their improvement, it is desirable to carry out a series of detailed and systematic experiments to determine how far it is possible to cross one " variety with another and to produce a progeny possessing definite ' and desirable characters in a larger degree than either parent. This " is a natural development of the present position, but the results " will entirely depend upon the skill and judgment brought to bear " upon them.

" 10. To assist in this work it may be found desirable to carry on " experiments of the kind suggested in the last paragraph at the " Botanical establishments at Jamaica, Trinidad, and British Guiana. " With this view, and the concurrence of the government at Barbados, " a few of the seedling canes, and if possible, some of the seed might " be distributed to these establishments for the joint observation and " investigations of the botanical and analytical officers connected with " these colonies.

" 11. As considerable interest is taken in this matter outside the " West Indies, Mr. Thiselton Dyer will be glad to receive a few " seedling canes for experimental cultivation at Kew. Further it is " important from a scientific point of view to obtain specimens of what " is known to be mature seed of the sugar cane, and to place such " specimens for examination and reference in the herbarium attached to " this establishment.

" I am, &c.,
" (Signed) D. Morris.

" Edward Wingfield, Esq., C.B.,
" Colonial Office, S.W."

CXV.—CINCHONA IN JAMAICA.

In a letter from the Colonial Office dated May 31, 1860, Lord Blachford (then Sir Frederick Rogers) informed Sir William Hooker, by the direction of the Duke of Newcastle, " that the gentlemen in charge of " the expedition to South America in search of seeds and plants of the " Cinchona tree have been instructed by the Secretary of State for " India in Council, to transmit any seeds that can be spared without " detriment to the supply for India to the Governors of Jamaica and " Trinidad, who have accordingly been requested to make preparations " in suitable spots for the reception of any seeds that may be conveyed " to them."

The result is recorded in the following quotation from the history of the enterprise given in the Jamaica Handbook for 1889–90, p. 136 :—

" By the month of October 1861," Mr. Wilson reported that he had " over 400 plants quite ready for planting out." As the climate of Bath was unsuitable for the successful growth of Cinchona, by the kindness of the late Dr. Hamilton, they were tried at Cold Spring Coffee Plantation, St. Andrew, at an elevation of 4,000 ft. There Mr. Wilson found " the climate and soil to be all he could desire, and as it afforded " every facility for carrying out so valuable an experiment, he at once " availed himself of it, and planted out in the coffee fields on the 16th

" of November 1861 several plants of each species there, about two " and two and a half inches in height. In twelve months after a plant " of the red bark (*Cinchona succirubra*) had attained to the height of " 44 inches, with leaves measuring 13½ inches long, by 8¾ inches " broad. The same plant in December 1863, *i.e.*, when two years " old, measured six feet in height, with 10 branches, having a " circumference of stem at base of 4½ inches.

The experience gained in these preliminary attempts paved the way for the larger enterprise undertaken by the Jamaica Government in 1868, from which date Cinchona planting in the island took a fresh departure. A further supply of seed consisting of *Cinchona officinalis* and *C. Calisaya* was obtained from Ceylon through Sir Joseph Hooker. Experimental plantations were started by Government " for the purpose " of the scientific culture of different species of Cinchona and for " supplying seeds, seedlings, and plants to private planters." In 1886 the Government Cinchona Plantations consisted of nine areas in the Blue Mountain District. The total extent planted with Cinchona of all varieties and ages was 143 acres. For the purpose of encouraging the cultivation of Cinchona by private enterprise, the Government Plantations during the last few years (*Handbook*, p. 132) " have distributed " 1,250 ounces of Cinchona seed, 1,200,000 Cinchona seedlings, and " 469,000 Cinchona plants."

Large shipments of Cinchona bark were made from the Government Plantations during the years 1879 to 1884, and the prices realized proved that the climate and soil of Jamaica were particularly well suited to the successful cultivation of Cinchona plants. As much as 10*s.* per pound was obtained for root bark of *Cinchona officinalis*, while on large shipments the average price realized was 6*s.* 7*d.* per pound. All the various species of Cinchona have been introduced to Jamaica including the valuable *Cinchona Ledgeriana*.

About 2,600 acres have been taken up by private planters for the cultivation of Cinchona in Jamaica, and the industry there is now well established. Owing, however, to the extraordinarily large shipments of Cinchona bark from Ceylon, the value of this valuable drug has so declined in European markets that at present it is almost unremunerative as a cultural product. As Jamaica was late in the field, and only now produces bark of sufficient age to be placed in the market, the planters are compelled to hold back their bark until there is such an improvement in the market as will justify regular shipments. This, it is hoped, will only be a question of time. Meanwhile, as two samples of Jamaica *Cinchona officinalis* bark, from trees six years old, grown on a private plantation at 5,000 feet, have been lately forwarded to Kew, the following reports obtained respecting them will prove of interest:—

DAVID HOWARD, Esq , to ROYAL GARDENS, KEW.

Stratford, near London, E.,
July 25, 1889.

DEAR SIR,

I HAVE completed the analysis of the Loxa bark from Jamaica, and find as follows (as alkaloids) :—

	Quinine.	Cinchonidine.	Cinchonine.	Amorphous.
No. 1 -	2·23 %	0·44 %	0·04 %	0·51 %
No. 2 -	1·74 %	0·57 %	0·06 %	0·55 %

in each case there was a trace of Quinidine.

The tests are thus very much what Loxa bark of similar appearance from South America would give. It is rather a Chaguera than a crispa or Uritusinga which gives the richer yields that characterises the finest officinalis from the Dodabetta plantations.

On the other hand the percentage of Cinchonidine and Cinchonine do not suggest any hybridization with succirubra.

I am, &c.,
(Signed) David Howard.

Messrs. Jenkin & Phillips to Royal Gardens, Kew.

21, Mincing Lane, E.C.,
29th July 1889.

Dear Sir,

We beg to acknowledge the receipt of your letter of the 25th July, enclosing copy of letter received from Mr. David Howard, giving analysis of two samples of Loxa bark from Jamaica.

On the market, now, bark analyzing as under would be worth, No. 1., 2·23 per cent. quinine, 2½*d.*, 2¾*d.* per lb.; No. 2., 1·74 per cent. quinine, 2*d.* per lb.

We shall at any time only be too happy to give you any information you may wish for about the market here for Cinchonas.

We may say in passing that the fine old South American H. O. Loxa quills mentioned in the letter by Mr. David Howard, are sold for the French market for making wine. This bark has a peculiar flavour and bouquet, which are recognised and well known by the Parisians, which fragrant quality or bouquet are quite wanting in the Loxa bark when grown in India, Jamaica, or Java. Fine silvery H. O. South American Loxa would fetch upon this market 2*s.* 2*d.* to 2*s.* 6*d.* per lb.

Thanking you for the sight of these two analyses.

We are, &c.
(Signed) Jenkin & Phillips.

D. Morris, Esq., M.A., F.L.S.

John Hamilton, Esq., to Royal Gardens, Kew.

c/o Messrs. S. Rucker & Co.,
12, Great Tower Street, London, E.C.,
July 31, 1889.

Dear Sir,

I now return the two copies of reports on the Jamaica bark, the perusal of which has much interested me. I am expecting some improvement in the value of Cinchona later in the year. Those who have good bark should not, in my opinion, be in too much of a hurry to realize. The market now is suffering *more* from a plethora of quinine than a redundancy of bark.

After this season, ending 30th September, I am told the exports from Ceylon will not again exceed eight million pounds, and the fall will come gradually from that point according to supply and demand requirements.

That there can arise any *large* increase in the value of bark during the next 18 months there are at present no grounds for supposing.

Thanking you again for your courtesy,

I am, &c.,
(Signed) John Hamilton.

D. Morris, Esq., M.A., F.L.S.

The information respecting the use of Loxa bark for wine-making purposes in France is of interest. It would appear from this that while Loxa bark from South America, with "a peculiar flavour and bouquet," is worth 2*s*. 2*d*. to 2*s*. 6*d*. per pound, a bark apparently similar in appearance and in percentage of quinine from India, Ceylon, or Jamaica is only worth 2½*d*. to 3*d*. per pound. The use of Cinchona bark for quinine wine-making can only prove of limited extent, but the subject possesses sufficient importance to deserve to be more fully investigated. Messrs. Jenkin and Phillips have very obligingly forwarded to Kew samples of South American Loxa bark of the character mentioned, and it is hoped to have it carefully tested for the special properties which it is said to possess.

The following letter removes a possible misconception as to the use to which Loxa Cinchona bark is at present applied :—

Messrs. JENKIN AND PHILLIPS to ROYAL GARDENS, KEW.

21, Mincing Lane, E.C.,
September 20, 1889.

SIR,

WE beg to acknowledge the receipt of your letter of the 19th instant, and presume that you have received the specimen sample of Loxa bark as requested.

We are sorry that we did not make our information so clear as we might have done in our letter to you, but as you justly interpreted it Loxa Cinchona bark (as far as we know) is only used in making a French liqueur, or tonic wine, and is sold by all Parisian apothecaries.

We are told by a Spaniard that the common Pitayo Bark, selling at 2*d*. to 3*d*. per lb., is sometimes used for giving sherry a body.

The H. O. and a crown, were brands adopted in the time of the Spanish dominion, for two different sorts of bark which are both included under the general title Crown Bark. It is imported from Payta.

Cortex Chinchonæ de Loxa Loxa bark.

We are, &c.,
(Signed) JENKIN AND PHILLIPS.

W. T. Thiselton Dyer, Esq., F.R.S., C.M.G.

CXVI.—GAMBIER.

(*Uncaria Gambier*, Roxb.)

"Gambier is an article which every tanner in the Kingdom uses "more or less, and no other can take its place." "It used to cost 10*l*. "per ton and now costs 45*l*."

It is sufficient to quote these two statements from correspondence which has recently been addressed to this establishment to justify the publication in the *Kew Bulletin* of an account of this very interesting commercial product.

At the present time Gambier is almost exclusively a monopoly of the Straits Settlements, and Singapore is the great emporium for it. The present state of the trade in it would seem to justify its extended cultivation as a planting industry in other parts of the tropics. With this object, copies of the following letter, addressed to Kew by Mr. W. N. Evans, a practical tanner, were sent early in the present year to the botanical authorities in British Guiana, British Honduras, Jamaica, Lagos, Natal, Niger Territory, Singapore, and Venezuela :

Mr. W. N. Evans, F.C.S., to Royal Gardens, Kew.

66, Stackpole Road, Bristol,
February 1, 1889.

Dear Sir,

Our trade has of late years been much interfered with by the difficulty of obtaining pure materials, especially Gambier, *Uncaria Gambier*, from Singapore. The American tanners are also now taking 50 per cent. or more of the supply. The adulteration is very bad, and the price 42*s.* per cwt., best cube was 27*s.*, block 16*s.* to 27*s.* Gambier is an article which almost every tanner in the kingdom uses more or less, and no other can take its place. Its re-actions with lime in the early stages of tanning being so very different from other tannins.

There is, however, now a determination on the part of many to rid themselves of the middlemen who come between them and the growers. We are contemplating, therefore, doing the whole trade. That is to grow the plant in Singapore or Borneo, manufacture with the best machinery, and send direct to warehouses here.

I have taken the liberty of writing to ask if you can give me any information on the subject. There are, I presume, botanical gardens at Singapore, and reliable managers who would furnish us with necessary details. What land was obtainable, difficulties of obtaining labour, &c. Of course we are fully aware that in starting a new scheme we should have to face strenuous opposition from the present dealers. But the trade has all to gain in doing an honest thing. May I also ask could the plant be grown at Natal, at the lower levels near the sea? And might it not be quite possible for the Royal Niger Company to cultivate it from cuttings or seed, as the climate must be somewhat similar as to moist heat?

I am, &c.,
(Signed) W. N. Evans.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.,
Royal Gardens, Kew.

It is hoped that the circulation by means of the *Kew Bulletin* of the information now put together will have the effect of drawing further practical attention to the subject.

The Gambier of commerce is obtained by boiling the leaves of *Uncaria Gambier*, Roxb., a shrubby climber, native of the Malay States. Gambier is official in the British Pharmacopœia under the name of Catechu Pallidum. It is also known as Pale Catechu and Terra Japonica.

The determination of the Gambier plant (*Uncaria Gambier*, Rox. Flor. Ind. 1,517) is fully discussed by Sir Joseph Hooker in the *Flora of British India*, Vol. iii, p. 31. It appears from this that the Ceylon *Uncaria Gambier* of Thwaites' *Enumeratio* is not identical with the true Gambier plant, and is referred to *Uncaria dasyoneura* var. *Thwaitesii*.

Uncaria Gambier is a strong shrubby climber, with opposite leaves, and with numerous small flowers closely crowded on small globular receptacles. The peduncles on which the flowers are borne are of singular structure, and after the fall of the inflorescence the lower portions become elongated, very hard, and curved into hooks by which the plant climbs. Sometimes these curious axillary hooks are produced without bearing any heads of flowers. The numerous seeds are very minute, and with a long transparent tail at each end. The plant is found wild or cultivated in Malacca, Penang, and Singapore, and also in Java and Sumatra.

The first published account of Gambier, according to Flückiger and Hanbury (*Pharmacographia*, p. 336), were communicated to the Batavian Society of Arts and Sciences in 1780, by a Dutch trader named Couperus. This writer narrates how the plant were introduced into Malacca from Pontjan in 1758, and how Gambier is made from its leaves; and he names several sorts of the drug and their prices. In 1807, a description of the drug called "Gutta Gambier," and of the plant from which it is made, was given in the Linnean Transactions, ix. (1808), pp. 218–224. The writer, Mr. William Hunter, Secretary of the Asiatic Society, well known for scientific observations in connexion with India, states that the substance is made chiefly at Malacca, Siak, and Rhio; that it is in the form of small squares or little round cakes, almost perfectly white, and that the finer sorts are used for chewing with betel leaf, in the same manner as Catechu, while the coarser are shipped to Batavia and China for use in tanning and dyeing. It was in doubt till Hunter's paper whether Gambier was the produce of *Acacia Catechu* or of a different plant.

Plantations of Gambier were commenced at Singapore in 1819, where at one time there were 800 plantations; but owing to scarcity of fuel, without which the manufacture is impossible, and the dearness of labour, Gambier planting was, in 1866, fast disappearing. Of late years, owing to an increased demand for the product, and higher prices, Gambier cultivation has rapidly recovered.

Gambier, as at present met with in commerce, is an earthy looking substance, of light brown, and sometimes of a yellow hue, consisting of cubes about an inch each side more or less agglutinated; it is sometimes in flat cakes, or in the form of entirely compact masses. A good series of specimens of Gambier in various forms is shown in the museums of Economic Botany at Kew [No. I., Case 58]. Some Gambier cubes are externally of a reddish brown colour, and compact. Internally they are of a pale cinnamon hue, dry, porous, friable, devoid of odour, but with a bitterish astringent taste, becoming subsequent sweetish. Under the microscope, the cubes of Gambier are seen to consist mainly of very small acicular crystals of Catechin (or Catechucic acid). In respect to the chemical composition, according to Bentley and Trimen, Gambier is essentially similar to Cutch or Black Catechu, obtained from *Acacia Catechu*. Like Cutch, also, Pale Catechu is said to contain a yellowish colouring matter, which has been named Quercetin.

Although by far the largest consumption of Gambier is in tanning and dyeing, an appreciable quantity of the finer qualities also used in medicine. It is especially valuable as an astringent. It is more readily soluble than the Catechu of *Acacia Catechu*, and is more powerful than Kino.

Pale Catechu or Gambier is largely used in diarrhœa and dysentery, in relaxed conditions of the uvula and palate, and for hoarseness in public speakers and singers.

Hunter states that :—

. . . . "For the cultivation of this plant, a rich red soil is preferred. It gives the most luxuriant crop when the rains are frequent, but does not thrive in grounds that are apt to be flooded. On this account the side of a hill is esteemed better than any other situation.

"The plants are propagated from seed.* In three months after sowing, they appear above the ground; after this they grow fast, and may be moved to the field when nine inches high. They are there planted at the distance of eight or nine feet, so that one *orlong* (of 80 yards square) contains about 700 plants. At the end of one year from the time when they are planted in the field, a small crop of the leaves is obtained. A larger is got in 18 months, and the third at the end of two years, when the bushes have attained their full growth. They continue in their prime, and admit of being cut twice a year, during a period of 20 or 30 years, provided care be taken to keep the ground clean and the roots free from weeds. Their tops must be cut, so as to prevent them from growing to a greater height than five or six feet."

---

* Simmonds ("Tropical Agriculture," p. 387), states that the plant is propagated either by seeds or cuttings, but the latter are preferred.

"From good ground and a garden well kept, 10 piculs (of 133⅓ lbs. each) of dry Gambier are usually obtained on every orlong twice a year, or 20 piculs per annum. As it is cut every six months, and should then be boiled off, the leaves ought to be of the same age, but, from a want of means, it offen happens that the year is nearly expired before the cutting is done, which should have been made at the end of six months. In this case the young leaves yield a whiter drug than the old."

The following more recent account is taken from the *Tropical Agriculturist* for September 1885, p. 204:—

"When a Chinaman wants to open a garden, the forest is felled and burned off as for coffee, the piece intended for pepper is dug up and prepared most carefully, pepper cuttings planted about eight feet apart, and a jungle post about 10 feet high sunk in the ground beside each plant, to which it is eventually trained. The balance of the clearing has very small holes cut about six feet apart, in which young Gambier plants are put and left to fight it out with the lalang grass (*Imperata Kœnigii*), ferns, and other weeds, which soon spring up. In 18 months from planting, the Gambier gives a return which helps the planter until his 1,000 or 2,000 pepper vines begin to give a crop when three years old. On each side of a Gambier and pepper garden there is a reserve of forest eight chains wide, in which he has the right of cutting any timber he may want for posts for his vines, firewood for boiling down his Gambier or for making burned earth, which with the refuse from the Gambier boilers, is the only manure applied to the pepper vines when the garden is any distance from a town. If a little more care was given to the Gambier, there can be no doubt that, not only would the returns be greater, but the garden would last much longer; the Gambier being generally worn out long before the pepper begins to fall."

The following particulars are taken from the *Straits Times* (See *Pharmaceutical Journal*, April, 1888, p. 863.):—

"The main points in Gambier planting which are so attractive to Chinamen, are the great rapidity with which they can get a crop out of the ground, and the small original outlay which is required. . . . . . . The leaf of the young Gambier plant is thick and fleshy, and yields a large quantity of extract; but as the shrub ages the leaves become thinner, and more fibrous in texture, and lose their characteristic fleshiness. In a little over 10 years a plantation is almost valueless, and as a general rule, is abandoned within 15 years. This result is certainly due to the savage treatment to which the shrub is subjected . . . . The shrubs are cut down with no sparing hand; leaves, shoots, and twigs, are all lopped off by the Chinaman's knife, and the plant is well nigh reduced to the condition of a mopstick, and left with barely sufficient leafage to enable it to carry on its existence. No attempt is made to manure the plantation. The soil, deprived of its natural shade, is left either to be burned into the consistency of a brick, or else the whole place is over-run with *lalang.* The only wonder is that a Gambier plantation is not used up sooner. It is quite an error to suppose that the plant exhausts the soil like indigo. . . . . The manufacture of Gambier is as barbarous as its cultivation. The green leaves and shoots are roughly chopped with a *parang* and thrown into a *qualli,* which is then filled up with water; the furnace below the iron pan is of the roughest possible construction, and consumes an immense quantity of firewood. While the leaves are boiling, they are incessantly prodded with a sort of wooden trident in order to break them up, and assist the process of maceration. When the amount of "gutta" which has exuded from the leaves causes the liquour to be thick and syrupy, the leaves are taken out and placed in a wooden trough which overhangs the pan at such an angle, that the liquor drains freely back into the pan from the steaming mass in the trough. The liquor in the *qualli* is then ladled into small and shallow wooden tubs; the leaves in the trough are once more swept into the pan and re-boiled, after which they are taken out and thrown outside to be afterwards carried off to the pepper garden. The liquor left in the *qualli* from the second boiling is too weak to be converted into Gambier, but is an excellent extract in which to boil up the next lot of green leaves. As soon as the extract in the small wooden tubs, already spoken of, is sufficiently cool to allow of the hand being placed in it, a very curious process of agitation is adopted by the Chinese, which it is difficult to clearly describe. The coolie squats before the tub, and plunges his half closed hand into its semi-fluid contents, and in the hollow thus formed by his hand, he incessantly works up and down a piece of light wood shaped like an elongated dice-box. The immediate effect of this treatment, is to cause the Gambier extract to thicken. In fact it sets up a process of crystallization; the extract assumes a concrete form, and becomes *Gambier.* When it is quite cool it is turned out from the tub, as from a mould, and cubed with a knife, which, as a rule, is made out of the iron hooping of a Manchester bale. The cubes are then put on coarse bamboo trays with wide meshes, the trays are placed in rudely constructed racks over the *dapur,* and should be left there for four or five days to get smoke-dried. The cubes at the end of this time, will have thrown off an immense percentage of water, and have become greatly reduced in size. . . . . . . In the ordinary run of Gambier, which merchants are now content to receive, there are no traces of cubing, and when cubes are to be discerned they are of an extraordinary size, the colour is of an unclean white to a dirty pale yellow, and the mass frequently steams."

The account of Gambier preparation given by Fluckiger and Hanbury (*Pharmacographia,* p. 337), differs in some slight details. It is borrowed from Jagor's *Singapore, Malacca* and *Java,* Berlin, 1866.

"The Gambier plants are allowed to grow 8 to 10 feet high, and as their foliage is always in season, each plant is stripped three or four times in the year. The apparatus and all that belongs to the manufacture of the extract are of the most primitive description. A shallow cast-iron pan about three feet across is built into an earthen fireplace. Water is poured into the pan, a fire is kindled, and the leaves and young shoots, freshly plucked, are scattered in, and boiled for about an hour. At the end of this time they are thrown on to a capacious sloping trough, the lower end of which projects into the pan, and squeezed with the hand so that the absorbed liquor may run back into the boiler. The decoction is then evaporated to the consistence of a thin syrup, and baled out into buckets. When sufficiently cool, it is subjected to a curious treatment; instead of simply stirring it round, the workman pushes a stick of soft wood in a sloping direction into each bucket, and, placing two such buckets before him, he works a stick up and down in each. The liquid thickens round the stick, and the thickened portion being constantly rubbed off while at the same time the whole is in motion, it gradually sets into a mass, a result which the workman affirms would never be produced by simple stirring round. Though we are not prepared to concur in the workman's opinion, it is reasonable to suppose that his manner of treating the liquor favours the crystallization of the catechin in a more concrete form than it might otherwise assume. The thickened mass, which is said by another writer to resemble soft yellowish clay, is now placed in shallow square boxes, and when somewhat hardened, is cut into cubes and dried in the shade. The leaves are boiled a second time, and finally washed in water, which water is saved for another operation. From information obtained in 1878 it would appear that now the prevailing part of Gambier is made by pressure into blocks.

" A plantation with five labourers contains on an average 70,000 to 80,000 shrubs, and yields 40 to 50 catties (1 catty$=1\frac{1}{3}$ lb.) of Gambier daily."

The United States Consul at Singapore, in view of the more extensive use of Gambier in his country, furnished a report on the industry (*Tropical Agriculturist*, vol. ii., pp. 321, 322), which supplements in one or two particulars the account already given. He states that " Rich Chinese capitalists, known as 'towkays,' upon the arrival of " shiploads of poor coolies from China, either hire them and make " contracts with them for planting and boiling Gambier, or they advance " them money upon condition of obtaining a certain share of the crop, " and take care that they receive the 'lion's share.' By dint of careful " management and great industry some of the coolies that plant on " shares, earn a little more than a living, and invest this in such a " careful manner in something or in some way, that in a few years " they become small 'towkays' themselves, and pretty soon wealthy " ones. There are to-day in Singapore immensely wealthy Chinese " 'towkays,' who were once Gambier-planting coolies.

* * * * * *

" Gambier is exported chiefly for tanneries in Europe and America " as a very excellent substitute for bark. It is also used for dyeing, " and in a purified state for medical purposes. I have also been told " that beer-brewers purchase it, but I have been unable to learn for " what special purpose—I suppose to give beer a dark brown colour; " if so, while it serves to cheat, it is at least harmless if not used too " freely.

" When I first came here Gambier was not largely exported to the " United States, and rather to Europe—England principally. At that " time it vacillated between \$3 to \$3·50 per picul, and that figure " was (for the common usual sort and not for 'cube') not often ex- " ceeded until the latter half of 1879, when it gradually rose, owing " to unprecedented demands, to \$4 and over, and this without getting " lower than \$4 to the present time.

" The exports of Gambier to the United States during the last three " years have amounted to \$1,060,619·05. Considering this large " quantity, it must be extensively used in tanning, and must be regarded " at home as a profitable material for that purpose."

From what has been already stated, it would appear that the cultivation and preparation of Gambier in Singapore and adjoining States is very much in the hands of the Chinese coolies, who carry on their operations under a system calculated to impoverish the soil, and produce an article of uncertain quality and often quite useless for commercial purposes. The demand for Gambier appears to be extending both in this country and in the United States, but the supply at present fails to satisfy consumers either as to the quality or quantity.

If the Gambier plant is capable of being successfully grown, and would yield its special product in other localities as well as it does in the Malay States, there is no reason why so valuable an industry should not be introduced to the West Coast of Africa or to such West Indian Colonies as Trinidad and Demerara. It does not necessarily follow that the same wasteful system of cultivation should be adopted in other Colonies. The matter is one which may very fairly be taken up in connexion with experimental cultures in Colonies where the necessary conditions exist for the successful growth of the plant. It evidently requires a deep, rich soil and a high range of temperature, associated with regular and abundant rainful. In other words, the climate should be tropical. As a guide to those who may be disposed to undertake the cultivation, it may be generally assumed that Gambier will thrive wherever such plants as Cacao, Vanilla, Ginger, and Bananas are successfully cultivated.

In the first instance, seeds might be obtained from the Straits Settlements. Owing, however, to the regular cropping of the leaves, the plants do not ripen seed regularly, and what is produced may be found somewhat shy in germinating. Plants of Gambier have been successfully introduced to the Royal Gardens, Kew. At present they are grown under stove treatment, and appear to be healthy and vigorous. There is not, however, at present any stock for distribution.

In the official statistics of imports into the United Kingdom, Cutch is unfortunately combined with Gambier. The figures for the last three years, are :—

Year.	Tons.	Value.
		£
1886 - - -	28,369	654,438
1887 - - - -	27,258	658,364
1888 - - -	28,135	704,731

The *Tropical Agriculturist* (April, 1889, p. 671), however, estimates that Cutch only amounts to about one-fifth of the total imported. Gambier therefore remains as the most important and preponderant tanning material in the commerce of the East.

CXVII.—FIBRE INDUSTRY AT THE BAHAMAS.

(*Agave rigida*, var. *Sisalana.*)

In the *Kew Bulletin* for March last, p. 57, information was given respecting a new Fibre industry at the Bahamas. Since that time specimens of the leaves of the plant have been received at Kew, and it has now been possible to determine the species, as shown in the following letter addressed to the Colonial Office:—

Royal Gardens, Kew, to the Colonial Office.

Sir, Royal Gardens, Kew, 18th July 1889.

With reference to your letter of the 14th February 1887, and subsequent correspondence on the subject of the "Pita" Fibre plant of the Bahamas, I am desired by Mr. Thiselton Dyer to inform you that he has lately received from Sir Ambrose Shea specimens of leaves of this plant, which have now enabled us to identify it.

2. When specimens of various fibre plants growing at the Bahamas were forwarded to Kew two years ago, a description of which was forwarded with my letter dated the 16th May 1887, the present plant was not among them. The various species of Agave are extremely difficult to distinguish, and it is quite possible that the plant described as No. 1 *Agave lurida* was sent to this country under the impression that it was identical with what is known locally as the "Pita plant."

3. The "Pita" of the Bahamas, which it is hoped will give rise to a successful local industry, from the specimens of leaves that have now reached Kew, is a most interesting and valuable plant. There can be little doubt it is *Agave Sisalana* of Perrine, now generally recognised as a variety of *Agave rigida* of Miller.

4. A good description of the plant, by Engelmann, is quoted in the "*Kew Bulletin* for March 1887, p. 5."

5. This plant has doubtless reached the Bahamas, where we understand it is perfectly naturalized, from Florida and Key West. It is the produce of the plants originally introduced to Florida by Perrine about 40 years ago. The absence of teeth on the leaves, their extreme length (often attaining 5—6 feet), and the robust and free-growing habit of the plant are qualities which render it one of the best, if not the best, fibre plant amongst known species of Agaves and Furcrœas.

6. The steps already taken of the Governor of the Bahamas to encourage the utilisation of this plant and establish a local fibre industry are fully justified by the intrinsic merits of this Agave, and by the reports which have been obtained in this country on the quality and value of the fibre.

* * * * *

I have, &c.
(Signed) D. Morris.

Edward Wingfield, Esq., C.B.,
Colonial Office.

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ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 35.] NOVEMBER. [1889.

CXVIII.—PHYLLOXERA REGULATIONS AT THE CAPE.

The following letter, enclosing a copy of the new regulations affecting the introduction of plants and bulbs, lately published in the Government Gazette of Cape Colony, dated August 27th, 1889, has been addressed to this establishment by the Agent General. It will be noticed that the regulations, dated the 15th May 1884, absolutely prohibiting the introduction of any plants, tubers, roots, or bulbs into the Cape Colony, have now been so far modified as to admit of the introduction to Cape Town of plants other than grape vines under certain specified conditions.

Sir Charles Mills, K.C.M.G., to Royal Gardens, Kew.

Sir, 112, Victoria Street, London, S.W.

I enclose, for your information, a copy of a recently issued proclamation revoking, so far as it relates to the port of Cape Town, the regulations prohibiting the introduction into the Colony, from places

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
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1889.

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beyond the boundaries thereof, of grapes, vines, trees, plants, roots, bulbs, &c.

I have, &c.
(Signed) CHARLES MILLS.

The Director,
Royal Gardens, Kew.

REGULATIONS.

1. The importation into this Colony, from places beyond the boundaries thereof, of all grape vines or cuttings, or portions of grape vines, is absolutely prohibited.

2. The importation in the port of Cape Town of trees or plants (other than grape vines), and of tubers, roots, and bulbs, from any place beyond the boundaries of this Colony, will only be allowed under the following conditions:—

(*a.*) No such trees or plants, tubers, roots, or bulbs with earth adhering thereto, or in pots or cases containing earth, with the exception of grafts packed in clay and seed potatoes, shall be introduced into the port of Cape Town.

(*b.*) A declaration from the consignor made before a magistrate or other local authority having the power of administering oaths, stating (1) that the articles proposed to be imported were taken from a field, garden, greenhouse, hothouse, or other place containing no vine plant or any portion thereof, either growing or stored; (2) the distance of the nearest vineyard, and whether such vineyard has at any time suffered or is suffering from the Phylloxera vastatrix, must be produced by the consignee before such articles shall be allowed to be landed.

(*c.*) All packages, cases, pots, or coverings whatsoever containing trees, plants, tubers, roots, or bulbs shall be examined, before landing, by an officer to be appointed for that purpose, and it shall be the duty of the consignee to open all such packages, cases, pots, or coverings, for the purpose of the examination aforesaid, and to afford every facility to the examining officer during his examination.

(*d.*) On the examining officer being satisfied as to the absence of the Phylloxera vastatrix from the articles proposed to be imported, and as to the sufficiency of the declaration in section (*b*) above mentioned, he shall give a certificate to that effect to the consignee, and without such certificate no such articles shall be landed.

(*e.*) Should it appear to the examining officer that there are reasons for suspecting that such articles may harbour the Phylloxera vastatrix, he may, if he think fit, order the said articles to be disinfected in such manner as the Government may from time to time require.

(*f.*) All packages, cases, pots, or coverings containing articles which shall be found to be infected with the Phylloxera vastatrix, together with the articles therein, shall be immediately destroyed.

(*g.*) The Government does not hold itself liable for any loss or damage that may occur from the destruction of articles or the packages containing them, or from any process that may be considered necessary to discover the existence or otherwise of the Phylloxera vastatrix.

CXIX.—COLLECTING AND PRESERVING FLESHY FUNGI.

I.

Information is continually being sought by collectors abroad as to the best means of preserving fleshy fungi, so as to send them home in a condition suitable for determination. It is by no means an easy task to advise, in a general manner, on such a subject, but a few hints may be of assistance. The large woody *Polyporei* and the leathery species of ***Stereum*** only require to be dried (flattened where possible) to be available for the herbarium. With the soft and fleshy Agarics the case is different, as they shrink out of all recognition, change colour, and are liable not only to decay, but also to quick demolition by insects. No satisfactory determination of these can be made unless accompanied by sketches of the form, size, and colour as in life. It is not absolutely essential that they should be coloured, although that is best, but the colours must always be stated on the drawings. To assist those who are not facile with the pencil, it is recommended that the specimen collected should be divided longitudinally through the cap, and down the centre of the stem. When this is done one half should be laid on a sheet of white paper, with the cut surface downwards, and the outline traced carefully upon the paper with a sharp pointed pencil. On removing the specimen there will be left upon the paper an outline of the form of the Agaric, natural size. This may be completed by hand, drawing in the line, marking the margin of the cap, indications of scales on the pileus (if any exist) the character of the ring (if present) and the scales, lines, or markings of the stem. Another copy of the section made side by side, on the same paper, would give the outline of the gills, and by a little care and practice it will be found easy to draw the line from the stem to the edge of the cap, indicating the point of junction of the gills with the flesh of the cap. This should be done very carefully and accurately, as it must be depended upon to show whether the gills are quite free from the stem, at their inner extremity, or whether they are adnexed, or whether they are decurrent, and to what extent they run down the stem. Then also it should be shown if the stem is solid or hollow. A little colouring, even if not artistic, would be more useful than mere description of the general appearance of the Agaric. Then should follow copious notes, embracing all the points essential to a true diagnosis :—whether growing on wood, or on the ground ; whether viscid when fresh, or perfectly dry ; whether of an agreeable or fetid odour ; whether quite smooth, or mealy, silky or scaly ; whether acrid to the taste, or pungent or mild ; whether moderately persistent or deliquescent ; and, if the sketch is not coloured, then to state the colour of the cap, the stem, and the gills, as explicitly as possible. It need scarcely be added that the locality and date should be indicated together with a number which should also be attached to the specimens or their remains. These latter should be dried as thoroughly as possible, and sent with the sketches.

The only process of drying which can be recommended, as applicable abroad, is to expose the Agarics or Boleti, or other fleshy fungi, to a free current of air so as completely to deprive them of moisture. Care must be taken at this point that the specimens are not attacked by insects. When dried but not brittle a little pressure may be used so that the specimens may be flattened to assure greater convenience in packing. Carefully cut sections through the centre of the pileus and stem would be an advantage, but insufficient by themselves. These may be dried between moderately absorbent paper which requires changing every few hours.

Collections made in this manner have always been fairly successful, in proportion as the instructions have been carried out. It is useless attempting to send home specimens of this kind in spirits, or any kind of preserving fluid, as they entirely lose colour and in some cases are completely destroyed.

Leaf fungi only require to be dried *flat* in the same manner that the foliage of flowering plants is dried for the herbarium, under pressure. All indications of colour should be given wherever this is liable to be changed in drying, or by age.

Some collectors send over specimens of fungi, dried indiscriminately, without notes, or information of any kind. All these are probably mixed up together in a single parcel, and left to their fate. All that such collections are fit for is to be thrown away, and the labour of collecting and the cost of sending is wasted. If specimens of this kind are worth the trouble of collecting at all, they at least merit a little more care, and should come to hand in a condition that would ensure their recognition.

Fleshy fungi, when undergoing a long voyage are very liable to the incursions of insects, and especially of a marauding weevil. If sketches are made the specimens may be poisoned before packing, but in all instances they should be quite dry when packed, and carbolic acid should not be used. Corrosive sublimate usually answers the purpose very well, although some of the weevils seem to despise it.

All specimens should be mature, or mature specimens should accompany those which are young and undeveloped. In collecting great care should be exercised to secure the whole base of the stem (when present) since it is of great importance for accurate determination.

M. C. Cooke.

II.

The group of fungi known as the *Gasteromycetes* includes the puffballs, earthstars, stinkhorns, &c., and judging from the mutilated specimens received from various parts of the world, contains numerous species of especial interest alike to the systematist and biologist. Mature specimens of all kinds should be allowed to remain exposed to the air until perfectly dry, which in many instances requires several days; when travelling, a convenient mode of drying is to pass a string through all the specimens of one kind along with the number label, and suspend them in a current of air. Most of the puffball family will bear this treatment, which is easy and successful; when dry, the specimens should *not be pressed at all*, but wrapped separately in paper and packed in boxes to prevent crushing. In cases where space cannot be afforded for unpressed specimens, the plants after being dried by exposure to the air may be subjected to a little pressure in packing between sheets of paper, the less the better, bearing in mind that soft, fleshy fungi of every description, which have been subjected to the amount of pressure during drying that is necessary for flowering plants, are in most instances absolutely valueless. Many species are covered with spines or warts that fall away during drying, hence it is necessary for the collector to make a note of such characters as are not likely to be observed in the dry state, such as the general character of the surface, whether scaly, spiny, warted, smooth, dry, or sticky; colour; and smell, if pronounced. The habitat is also of importance, whether growing on earth, wood, amongst leaves, &c.; as also is the habit, whether solitary, gregarious, crowded, &c.

Collectors as a rule gather mature specimens only, but for the purpose of ascertaining the structure and affinities, *young specimens are* also *indispensable*, and should, if possible, be preserved in spirit; dry mature specimens should accompany the young plants preserved in spirit.

Chloral hydrate, in the proportion of an ounce to a quart of water, answers better for the preservation of fungi intended for microscopic investigation than spirit, unless absolute alcohol is used; it will also be found an excellent medium for the preservation of delicate liverworts, seaweeds, &c., as it causes no contraction or hardening of the tissues, and does not affect the colour.

G. MASSEE.

CXX.—OIL PALM IN LABUAN.—A SUCCESS AND A FAILURE.

(*Elæis guineensis.*)

One of the duties which is cheerfully undertaken by the Royal Gardens is to assist any Dependency of the Empire in introducing and establishing any new plant which promises to serve as the foundation of a new industry. Every attempt of the kind, as far as the Colonies are concerned, is generally undertaken on the initiative of the Colonial Office. While Kew assists in the technical details of the experiment and performs the duty of obtaining, receiving, cultivating, and transmitting the plants required to their new destination, it is only a matter of justice to say that the Colonial Office spares no pains to make the experiment a success, and aids in every possible way in bringing the experience and local knowledge of one part of the Empire to the aid of another. It would be difficult indeed to withhold co-operation from a body of men so anxious to carry out every suggestion which holds out the faintest possibility of leading to a useful result.

The following protracted correspondence (of which, however, only a portion has been selected for publication) is printed in order to afford an example of the amount of work which is involved in carrying out even a comparatively simple experiment. The enterprise is suggested; it is considered; a plan for carrying it out has to be matured; all the necessary incidental information has to be collected; and then the plan is carried into execution. Sometimes it fails the first time, and then a second attempt has to be made, and so on till success is secured. All that then remains is to wait for the result; and this, in any appreciable shape, will in most cases not be reached for years.

But in the interval Governors and officials change. It may be, though it is not always so, that the ardour with which the experiment was launched evaporates with the individual whom it inspired. A new Colonial Government *régime* may regard with apathy and even hostility the work of its predecessor, and the whole enterprise may fall into oblivion till some chance inquiry on the same subject leads to the digging out of the file of papers containing its record from the Kew archives.

The introduction of the Oil Palm from the Gold Coast into Labuan is such a story. The work was done, the trees grew and even fruited, and ten years later were grubbed up.

In the course of last month an application has been received from the Queensland Government for a supply of seeds of the Oil Palm for experimental cultivation in that Colony.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, December 7, 1876.

I AM directed by the Earl of Carnarvon to transmit to you a copy of a despatch received by the last mail from the Governor of Labuan, suggesting that it would be well to promote in Labuan the cultivation of the African Oil Palm.

Before taking any steps to carry into effect the wishes of the Governor his Lordship would be glad to receive your opinion as to the despatch of seed nuts or any other observations your experience may suggest on the matter.

I am, &c.
(Signed) R. H. MEADE.

Dr. Hooker,
Royal Gardens, Kew.

Governor USSHER to the EARL OF CARNARVON.

Government House, Labuan,
October 14, 1876.

MY LORD,

IN a conversation I have had with Mr. Treacher, the Acting Colonial Secretary, I endeavoured to explain to him the nature, uses, and cultivation of the *Elæis guineensis* or African Oil Palm.

2. It struck both him and myself that it might prove an industry well calculated for Labuan and the neighbouring islands, and that the rough unskilled labour required in boiling down the nuts for oil would be well adapted to a people, one of whose principal industries is the manufacture of cocoa-nut oil.

3. I venture therefore to suggest that your Lordship should cause to be shipped to the Colony, at its own expense, a few cwts. of the nuts for distribution and planting. Mr. Treacher himself would take the major part, as the island of Daat, belonging to his cousin, Dr. Treacher, is well adapted to palms, 20,000 fine cocoa-nut palms being already on the island, where a few years ago nothing but jungle was to be seen.

4. Any information as to the process used by the African natives for its conversion into oil, its cultivation, and the probability of its finding a market in Australia, would be highly desirable, and a portion of this information might, I think, easily be furnished by the Governor of the Gold Coast or the Administrator of Lagos, where the products of the oil palm are principal articles of export.

I have, &c.
(Signed) H. J. USSHER,
Governor.

The Right Hon.
The Earl of Carnarvon,
&c. &c. &c.

Messrs. JAMES IRVINE & CO. to ROYAL GARDENS, KEW.

Commercial Buildings, Liverpool,
December 27, 1876.

DEAR SIR,

I HAVE much pleasure in acknowledging receipt of yours of yesterday's date, asking for a bunch of the African Oil Palm kernels, which I think I can easily procure.

We have an intelligent correspondent from Monrovia in our office at the moment, and he suggests that the better plan would be to procure the bundle just as it is turning ripe, and send it home there and then, packed dry in an air-tight barrel.

I am, &c.
(Signed) JAMES IRVINE.

W. T. Thiselton Dyer, Esq.,
Royal Gardens, Kew.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, January 3, 1877.

I AM directed by the Earl of Carnarvon to convey to you his Lordship's thanks for your letter of the 26th of December, on the proposed cultivation of the African Oil Palm in Labuan.

The Governors of Sierra Leone and the Gold Coast have been requested, as suggested by you, to supply any useful information on the details of the industry which they may be able to collect. When replies have been received they shall be communicated to you.

I am, &c.
(Signed) H. R. MEADE.

Dr. Hooker, C.B.

Messrs. JAMES IRVINE & CO. to ROYAL GARDENS, KEW.

Commercial Buildings, Liverpool,
January 25, 1877.

SIR,

FOLLOWING up my last, I now have pleasure in advising you that I have this day sent off a small parcel of Palm kernels, which was specially selected from a large quantity.

They are as fresh as it is possible to get them under the circumstances, and I hope they will germinate. I am told that they have repeatedly been planted, and have always failed to grow; however, with the extra advantages of Kew and Kew superintendents, perhaps they may grow with you.

The ones I have written for from the Coast will come in the shell and fresh from the trees, and I should quite expect that they will germinate; I expect them in about six weeks.

Yours, &c.
(Signed) JAMES IRVINE.

W. T. Thiselton Dyer, Esq.,
Royal Gardens, Kew.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, June 8, 1877.

I AM directed by the Secretary of State for the Colonies to acknowledge the receipt of your letter of the 22nd of March, in reference to the cultivation of the African Oil Palm, and to transmit to you a copy of a despatch from the Governor of the Gold Coast on the subject.

I am, &c.

(Signed) ROBERT G. W. HERBERT.

J. D. Hooker, Esq., M.D.

Governor FREELING to the EARL OF CARNARVON.

Government House, Christiansborg Castle,
MY LORD, Accra, April 18, 1877.

IN reply to your Lordship's despatch, Gold Coast, No. 368, of the 2nd January last, requesting to be furnished with any useful details connected with the Palm Oil industry on the West Coast of Africa, from a report thereon which I have received, in which the subject is divided into two heads, Cultivation and Produce, I beg to quote as follows:—

Cultivation.—The ripe nut is selected for this purpose; the ground is first well raked, and the nuts scattered broadcast over it, and lightly covered with earth, or a number of nuts, ranging from six to ten, is deposited in one spot at various distances, and covered with earth. The planting must be during the rainy season, as it requires a good quantity of water. When the young shoots have grown to about a foot in height they are carefully removed in the evening, and transplanted a distance of at least 15 feet from one another, and if planted during one season, it is better to allow them to remain until the next before they are transplanted.

The African Oil Palm grows luxuriantly and bears more abundantly at the height of from 10 to 12 feet in a damp semi-marshy soil and where water does not, however, stand. In arid dry soil it becomes stumpy and grows very slowly, and sometimes bears at 4 feet, but to cultivate the plant so as to ensure a proper growth, a development of a good number of nut branches, large in size, with nuts well supplied with flesh or what is technically called "fat nuts," the trees must be at a distance of at least 20 feet from one another, and well supplied with water.

The supply of nuts fit for use is biennial, but the most abundant supply of commercial oil is obtained from nuts gathered during the rainy season.

Commercial Palm Oil manufacture. — The nut bunches are cut down from the trees and put in a heap outside in the air, where they are allowed to remain for a week or 10 days, which causes the joints of the nuts to be weakened by the process of decomposition, and allows them to be detached by simply beating them against any substance; the nuts are gathered and the husks (decayed sepals) that adhere to their base removed, either by the hand or by rubbing them together, and separated by throwing them in the air and allowing a strong breeze to blow them away. A hole about 4 feet is dug in the earth, which is lined with plantain leaves into which the nuts with the hard unyielding pulp, are put and covered over first with plantain leaves and then with palm leaves and earth. The nuts are allowed to remain here for various periods, from three weeks to three months, until decomposition of a more or less extent has taken place, so that when removed the pulp is soft and appears as if it had been thoroughly boiled.

They are now put into a trough made by digging a hole 4 feet in depth into the earth, and paving it below and around with rough stones. In some cases a portion of the nuts is boiled in iron or earthenware pots, and then mixed with the unboiled portion, before putting into the trough.

They are now pounded with wooden pestles by several persons standing round the trough until the pulp is quite removed from the surface of the hard nut; the whole is removed from the trough, put into a heap, and the stones taken out, leaving the oily fibrous pulp, which is put into a pot with a small quantity of water under a good fire, and well stirred until the oil begins to melt out. The pulp is then removed and put into a rough net opened at both ends, to which are attached two or three short sticks, by turning which at opposite directions the oil is squeezed out; from the nettings it runs into a receiver or tub leaving the fibre behind. The longer the oil nuts remain underground the thicker the oil will be when made, the quality will also be inferior and the smell bad; cæteris paribus, the shorter time, within certain limits, the nuts are underground, the more superior will be the quality of the oil made from them. This in a great measure will account for the difference in the quality of the oil shipped from different parts of the coast.

Palm Oil for home consumption.—The nut bunches are kept in a hot place for three or four days and the nuts are taken out, a small quantity, from 3 to 4 lbs., is made at a time; they are boiled in iron pots, then put into a wooden mortar and pounded with wooden pestles. The pulpy mass is then mixed with tepid water with the hand, the chaff is first removed and afterwards the stones. The oil remains mixed in the water, which is passed through a sieve to remove the remaining chaff into a pot placed on the fire and heated to boiling point, and allowed to continue in that state whilst the oil floats up as a bright red substance; the water at this stage is being continually stirred and the oil removed as it floats up until the whole is removed. The oil is now put into a pot and heated to drive out any water it may contain.

Second Palm Kernel Oil. — (a.) White; (b.) Brown or Black. The nuts which have been subjected to the process already described in making oil deprived of their external pulp, or old nuts picked up from under the Palm tree, are put in the sun for days and even months until they are perfectly dry; they are then broken between two stones, and the kernels obtained whole or in perfect condition and fit for exportation; this is the commercial Palm kernel. If they have not been perfectly dried the kernels break into pieces.

(a.) *White Kernel Oil.*—The kernels are put into a wooden mortar and pounded very fine, then removed to a grinding stone and ground into a homogeneous mass, which is put into cold water and stirred with the hand: the oil rises in white lumps on the surface of the water, which is collected and boiled; it is of a very light straw colour, and when exposed to the sun and dew becomes after a time perfectly white.

(b.) *Brown or Black Kernel Oil.*—The kernels are put into a pan and fried; the oil oozes out into it from them and it is strained; the fried nuts are put into a wooden mortar, pounded, and afterwards finely ground on a grinding stone; the mass is thrown into a small quantity of boiling water and stirred continually; the oil rises as a supernatant fluid and is removed until none rises. The pulpy mass is removed from the fire and spread out in a large bowl and allowed to cool, after which it is again ground and put by until the cool of the day, when it is mixed with a little water to soften it. It is now beaten with the hand for some time until the oil comes out in white pellets. As soon as this is observed a large quantity of water is put into it, and the oil in some fatty substance floats on the top, which is skimmed off and boiled and the pure oil obtained.

Under the circumstance detailed above, the exported kernel could not retain its germinative power, besides, I think, like the Cocoa-nut and other plants of the palm tribe for plantation, the nut requires the hard exterior covering for protection in the earth."

I have, &c.
(Signed) S. FREELING,
Governor.

The Right Hon.
The Earl of Carnarvon,
&c. &c. &c.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR,
Downing Street, July 23, 1877.

WITH reference to the letter to you from this office of the 8th June and to other correspondence, I am directed by the Secretary of State for the Colonies to transmit to you, for your information, a copy of a despatch from the Governor of Labuan, thanking you for the trouble which you have taken in obtaining Palm Oil nuts for that Colony.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

Sir J. Hooker.

GOVERNOR USSHER to the EARL OF CARNARVON.

Government House, Labuan,
June 2, 1877.

MY LORD,

I HAVE the honour to acknowledge the receipt of a box of Palm Oil nuts from Dr. Hooker, as notified in your Lordship's despatch, No. 13, of the 31st March, and I have to beg your Lordship to be good enough to thank Dr. Hooker for the trouble he has taken in the matter and for the information he has kindly collected.

2. The nuts will shortly be planted, and I trust will prove successful.

I have, &c.
(Signed) H. J. USSHER,
Governor.

The Right Hon.
The Earl of Carnarvon,
&c. &c. &c.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, October 5, 1877.

With reference to the letter from this Department of 8th June, I am directed by the Earl of Carnarvon to transmit to you a copy of a despatch from the Governor of Labuan acknowledging the receipt of a report from Governor Freeling upon the methods of extracting the oil from the Oil Palm of West Africa.

(Signed) R. H. Meade.

Sir J. D. Hooker, K.C.S.I., C.B.

Governor Ussher to the Earl of Carnarvon.

Government House, Labuan,
My Lord, July 25, 1877.

I have the honour to acknowledge the receipt of your Lordship's despatch, No. 29, of the 30th May, transmitting a report from Governor Freeling upon the methods of extracting the oil from the Oil Palm of South Africa.

2. I have the honour to request your Lordship to convey to Mr. Freeling the thanks of this Government for the trouble taken by him in the matter.

3. The nuts sent out are in the hands of Mr. Treacher, who will endeavour to form a large plantation on his cousin's property, the fertile island of Daat. Dr. Treacher had already cleared much of the jungle and planted 20,000 cocoa-nut trees, which are bringing in an annual income of nearly 500*l*. If the present parcel of nuts prove a success, as regards their first growth, I purpose, towards the close of the year, requesting that another consignment may be sent to us of about ten "heads" of nuts, to be planted in June or July 1878. This will give about 3,000 trees, and as in some cases fruit is borne by trees of four and five years old, the results of the attempt will be determined within that time.

I have, &c.
(Signed) H. J. Ussher,
Governor.

The Right Hon.
The Earl of Carnarvon,
&c. &c. &c.

Acting-Governor Treacher to Royal Gardens, Kew.

Government House, Labuan,
Sir, August 26, 1878.

Referring to your letter of the 16th June 1877, I beg to transmit herewith copy of a despatch addressed by me to the Secretary of State for the Colonies, from which you will perceive that from the seeds of the *Elæis guineensis*, kindly supplied to this Government by Sir Joseph Hooker, some 700 trees have sprung up and are in a very healthy condition.

I take this opportunity to request you to convey to Sir Joseph Hooker the thanks of this Government for the trouble he has been good enough to take in this matter.

I have, &c.
(Signed) W. H. Treacher,
Acting-Governor.

W. T. Thiselton Dyer, Esq.,
&c. &c. &c.
Kew Gardens.

Administrator TREACHER to COLONIAL OFFICE.

Government House, Labuan,
August 26, 1878.

SIR,

WITH reference to the despatches noted in the margin, I have the honour to report that from the seeds of the *Elæis guineensis* sent out to Labuan, at the suggestion of Governor Ussher, by the authorities of Kew Gardens, and which were sown on the Island of Daat, some 700 trees have sprung up.

2. The seeds were planted in August 1877, and notwithstanding a drought, which was quite exceptional and lasted for nearly five months, the young trees flourished, and were transplanted in July last.

3. Mr. Burbidge, a practical botanist travelling here for the firm of Veitch and Sons, Chelsea, and who is ever willing to give others the benefit of his botanical knowledge and experience, saw the trees before and after transplantation, and pronounces them to be in the most healthy condition.

4. As I have already reported, jungle fires prevailed extensively during the drought above alluded to, denuding, or rather completing the denudation of considerable tracts of uncultivated land formerly covered with fine timber trees.

I have, &c.
(Signed) W. H. TREACHER,
Administrator.

The Right Hon.
Sir Michael Hicks-Beach, M.P.,
&c. &c. &c.
Colonial Office.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR,

Royal Gardens, Kew, June 17, 1889.

I AM desired by Mr. Thiselton Dyer to inform you that an inquiry was made at Kew respecting an experiment undertaken in the years 1876–78 to establish the African Oil Palm (*Elæis guineensis*) in Labuan.

2. The seeds for the purpose were obtained by Kew at the request of the Colonial Office, and from a copy of a despatch enclosed in your letter of the 18th October 1878, it appears that 700 plants were raised on the island of Daat, most of which were successfully transplanted in July of that year. No information later than 1878 has reached this establishment.

3. In view of the inquiry already mentioned, and for the purpose of completing the records respecting a very interesting experiment, Mr. Thiselton Dyer will be glad if the Secretary of State will approve of a reference being made to the Government of Labuan to obtain a summary of the results attained in this instance.

(Signed) D. MORRIS.

Sir Robert G. W. Herbert, K.C.B.,
Colonial Office.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, June 21, 1889.

I AM directed by the Secretary of State for the Colonies to acknowledge the receipt of your letter of the 17th instant, making inquiry as to the cultivation of the African Oil Palm in Labuan, and to inform you that a copy has been transmitted to the Governor for his report.

I am, &c.

The Director of (Signed) ROBERT G. W. HERBERT.
Kew Gardens.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, September 25, 1889.

I AM directed by the Secretary of State for the Colonies to transmit to you, for your information, with reference to the letter from this department of the 21st of June, a copy of the despatch noted in the subjoined schedule on the subject of the African Oil Palm in Labuan.

I am, &c.

The Director of the (Signed) ROBERT G. W, HERBERT.
Royal Gardens, Kew.

ACTING-GOVERNOR OF LABUAN to COLONIAL OFFICE.

"Cultivation of the African Oil Palm in Labuan."

As reported in Mr. Treacher's despatch, No. 72 of the 26th August 1878, it appears that 700 of these palms were raised in the island of Daat, and in due time produced nuts. No attempt as far as I am aware was ever made to manufacture any oil from the nuts, and last year the Palms were all removed to make room for Cocoa-nut trees.

Daat, a dependency of this Colony, is private property, and I venture to suggest that should any further information be required by Mr. Thiselton Dyer, that he should apply to the owner, Dr. Peter Leys, who is now in England, and who would no doubt be glad to supply it.

The experiment, so far as I am in a position to judge, was a success.

(Signed) A. S. HAMILTON,
Labuan, 1st August 1889. Acting Governor.

CXXI.—RAMIE or RHEA.

(*Boehmeria nivea*, Hk. & Arn.
Boehmeria nivea, var. *tenacissima*, Gaud.)

Readers of the *Kew Bulletin* will have noticed that considerable attention has been devoted in its pages to the subject of the present note. The previous history of Ramie or Rhea, and of the various efforts that have been made in recent years to render its valuable fibre available for commercial enterprise, have been already fully summarised (*Kew Bulletin*, 1888, pp. 145–149; pp. 273–280; and pp. 297, 298). During the present year interest in Ramie appears to have become more and more general, and judging by the correspondence addressed to this establishment the subject is followed with keen interest at home as well as in India and the Colonies.

In connexion with the Paris *Exposition Universelle*, 1889, a special series of trials was held of machines and processes for decorticating Ramie (Exposition Universelle: Essais spéciaux de machines et appareils pour la décortication de la Ramie), and at the request of the India Office, and in continuation of similar action taken last year, Mr. D. Morris, F.L.S., the Assistant Director, was appointed to represent this country and to prepare a report of the results. This report, with the permission of the Secretary of State for India, is reproduced below:—

Royal Gardens, Kew, October 26, 1889.

A series of interesting trials of machines and processes designed for the decortication of Ramie was held by the French Minister of Agriculture at Paris in 1888, and a report on the subject, which I had the honour to prepare for the information of the Secretary of State for India in Council, was published in the *Kew Bulletin*, 1888, pp. 273–280.

These trials were resumed this year as an integral part of the *Concours spéciaux des instruments agricoles* of the Exposition Universelle, and opened on the 23rd September last. The jury consisted for the most part of the members of the Commission of 1888. The attendance of foreign representatives was considerably larger than in 1888, and the greatest interest was manifested in the proceedings by a large concourse of visitors.

The machines and processes this year were confined to those which had been shown as a regular part of the general exhibition. As will be seen later, all the competitors were French, and this in spite of the fact that more than a dozen machines and processes have lately been designed in this country, which are now in course of being carefully tested.

In my previous report it was pointed out that amongst the French there was attached an importance beyond their value to machines for cleaning Ramie in the dry state. I ventured to express the opinion (p. 278), that as regards India and our own Colonies it was essential that Ramie machines and processes should be competent to deal successfully with the green stems and not the dry; and that until this end was gained Ramie fibre would, I feared, continue to remain unavailable for commercial enterprise. At the recent trials this was all changed. It was a noticeable feature throughout the proceedings this year that no importance whatever was attached to the decortication of dry Ramie stems. The trials were entirely confined to results obtainable with green stems, and in order to make them still more applicable to field operations some of the stems were supplied freshly cut with leaves and some without leaves.

The following six machines and one process were submitted to the jury :—

1. E. Armand—Paul Barbier, 46, Boulevard Richard-Lenoir, Paris.
2. P. A. Favier—Société la Ramie Française—14, Rue Saint-Fiacre, Paris [for treatment of dry Ramie stems].
3. P. A. Favier—Société la Ramie Française—14, Rue Saint-Fiacre, Paris [for treatment of green Ramie stems].
4. Norbert de Landtsheer, 2, Place des Batignolles, Paris [large machine].
5. Norbert de Landtsheer, 2, Place des Batignolles, Paris [small machine].
6. Félicien Michotte, 43, Rue de Saintonge, Paris.
7. Ch. Crozat de Fleury et A. Moriceau, Villiers-le-Bel, Seine-et-Oise [process for the treatment of green Ramie stems in the field].

BARBIER MACHINE.

The machine of M. E. Armand, constructed by Barbier, and more generally known as the Barbier machine, was in every respect the same as that tried in 1888, and described in my previous report. It is constructed to be worked by hand or by steam power. It weighs 625 kilos., and the price is 48*l*. The construction of the machine is comparatively simple, and consists of a number of cylinders and beaters with a reverse action attached. This latter, allows the stalks to be withdrawn when about five-sevenths cleaned, and of the other ends being put in to complete the operation. The disadvantage of this method, as regards time and output of ribbons, is more fully discussed under the De Landtsheer (small) machine. During the trials this machine caused a considerable loss of fibre, carried away with the pith and wood. In the first trials 10 kilos. of green stems without leaves were passed through the machine in six minutes. The result was 1·300 kilos. of wet ribbons of fair quality. This would be at the rate of 130 kilos. of wet ribbons per day of 10 hours; or of 96 pounds (avoir.) of dry ribbons for the same period.

In the second trials 24 kilos. of stems with leaves were put through the machine in 10½ minutes. The result was 1·200 kilos. of wet ribbons of moderate quality. This would be at the rate of 68·500 kilos. of wet ribbons per day of 10 hours; or of 50 pounds (avoir.) of dry ribbons for the same period.

Taking into consideration the cost of this machine and the power necessary to drive it, the out-turn of ribbons is much too small to prove remunerative, and the machine in its present form is useless. Better results than these have been obtained by decorticating Ramie by hand.

FAVIER MACHINE.

Two machines were shown by M. P. A. Favier, whose name is well known in connexion with the Ramie industry. Machine No. 1 was designed for the decortication of green Ramie stems, while Machine No. 3 was designed for the treatment of dry stems. In this report the remarks apply only to Machine No. 1. This machine was 2 m. long, 80 cm. broad, and weighed 800 kilos. The price was not stated. It required three-quarter horse power to drive it, and two persons to feed and receive the ribbons. The machine is adapted to be worked by four persons, but at the trials, owing to want of space, it was worked with only two persons. M. Favier stated that it was designed to produce ribbons entirely free from wood and pith, ready to be converted by a chemical process, also by the same inventor, into the finest filasse ready for weaving. In outward appearance the machine was a long narrow iron box furnished with numerous small cylindrical crushers and beaters. These were entirely covered by a number of moveable iron sheets, which both protected the intricate system of cylinders and prevented the escape of dust and *débris.* The feeding apparatus consisted of a long narrow trough, in which the stems were arranged in lots of four to six and fed to the machine at two apertures leading to the rollers. The first pair of rollers was furnished with fine corrugations to grasp the stems and pass them on to a somewhat complicated system of crushers and beaters. The ribbons passed continuously through the machine, and were ultimately delivered into the hands of a workman at the other end perfectly free from wood and pith. In the first series of trials 10 kilos. of green stems without leaves were passed through the machine in 4½ minutes. Once or twice some of the ribbons were caught in the rollers and the machine had to be stopped. The time occupied in these stoppages was not counted. The wet ribbons yielded by 10 kilos. of stems weighed 2·820 kilos. This would be at the rate of 376 kilos. of wet ribbons per day of 10 hours; or, 276 pounds (avoir.) of dry ribbons for the same period. In the second series stems, more or less with leaves, weighing 60·350 kilos. were passed through the machine in 18 minutes. They yielded 18·100 kilos. of wet ribbons. This would be at the rate of 603 kilos. of wet ribbons per day of 10 hours; or 443 pounds (avoir.) of dry ribbons for the same period.

The ribbons in both cases were well cleaned. There appeared to be no waste. The *débris* under the machine consisted almost entirely of wood and pith.

These results I regard on the whole as satisfactory.

The somewhat intricate character of the various parts of this machine would be against its general use by planters in the Colonies, but there can be but little doubt it is a great advance on most other Ramie machines now available. It might, however, be adapted for use in central factories or *usines* where skilled labour would be obtainable, and for this and similar purposes the Favier machine may be recommended.

MICHOTTE MACHINE.

The Michotte Machine, called "La Française," at first glance resembled the Barbier and De Landtsheer (small) machines. It was driven by steam-power, and consisted of a pair of large rollers, each furnished with helicoidal grooves running their whole length. The large rollers first crushed the green stems and then passed them on to beaters with moveable bars intended to get rid of the wood and pith. In the first trials, 7 kilos. of green stems were passed through the machine in 1½ minutes, yielding 1 kilo. of badly cleaned ribbons. In the second trial 17·400 kilos. were passed through in 2½ minutes, yielding 6 kilos. of similar ribbons. In both cases the ribbons were mixed with crushed and mangled stems, full of wood and pith. The fibres were also cut transversely (probably by the helicoidal grooves) and rendered useless.

This machine in its present state possesses no merit whatever. It is difficult to realise under what circumstances it could have been entered for trial.

DE LANDTSHEER MACHINES.

M. de Landtsheer exhibited two machines. The small machine was very similar to that exhibited by him in 1888, but meanwhile it had received some slight modifications intended to accelerate its movements. It was driven by steam-power and required two men to attend to it. It had a horizontal feed plate, and consisted of a series of rollers and beaters which received eight or ten stems at a time. These were cleaned for about five-sevenths of their length, and by a reverse action (operated by a long handle pushed by the workman) they were then withdrawn and the other ends put in and cleaned. It will be noticed that each lot of stems, under this arrangement, had to be presented twice to the machine before they were cleaned. This involved a considerable loss of time and reduced the daily out-turn of ribbons. In the Favier machine, as also in the De Landtsheer large machine, this difficulty has in a great measure been overcome. The De Landtsheer small machine was used for green stems in the second trials only. In these 24·400 kilos. of stems, with leaves, were passed through the machine in 10 minutes. The yield was 6·500 kilos. of wet ribbons of good quality. This would be at the rate of 390 kilos. of wet ribbons per day of 10 hours; or 286 pounds (avoir.) of dry ribbons for the same period.

In the first trials this machine was used by de Landtsheer to complete the cleaning of ribbons previously passed through the large machine. In this instance 15 kilos. of partially cleaned and wet ribbons were passed through the machine in 6¾ minutes. The yield was 10·500 kilos. of excellent fibre worth, according to the opinion of experts, about 70 to 80 centimes per kilo.

The large machine of M. de Landtsheer, like the Favier machines, had a continuous movement by means of which the stalks passed through the machine, without withdrawal, and the ribbons were delivered at the other end ready for drying. This is an important point gained. Indeed, this was the principal improvement noticed in the machines presented at the Paris trials of 1889, and in all in which it had been adopted there was a marked increase in the out-turn of ribbons. M. de Landtsheer's large machine consists of two pairs of cylinders. The first pair is furnished with grooves opposite one another, while the second have the grooves alternate. Beyond these are two sets of beaters (batteurs à ailettes) which break and get rid of the wood and pith and deliver the ribbons on a revolving stage placed beneath, whence they are quickly picked up by a workman and laid on one side. The particulars of weight and price of this new machine were not obtainable. It was driven by a two-horse power engine and required two men to feed it and remove the ribbons.

In the first trial, 36 kilos. of stems without leaves were passed through the machine in 2½ minutes. They yielded 10 kilos. of wet ribbons, but these ribbons had a considerable quantity of pith and wood lightly adhering to them, and in one instance the amount of wood and pith probably reached 20 to 25 per cent. of the gross weight. Taking the yield of wet ribbons as they left the machine, the 10 kilos. above mentioned would be at the rate of 2,400 kilos. of ribbons per day of 10 hours; or of 1,763 pounds (avoir.) of dry ribbons for the same period. Even allowing for the presence of pith and wood, which, when dry, might be removed by a light shaking or scutching, it is evident that this machine will prepare more than half a ton of dry ribbons per day. It is not at all improbable that M. de Landtsheer will be able to effect some further improvement in this machine. In any case the machine is worthy the attention of planters, who with a single instrument could work off about 50 tons of green stems per week. This is an exceptionally good result, and it serves to show what progress has now been made in perfecting machines for treating the Ramie plant on a commercial scale.

In the second trials 46 kilos. of stems with leaves were put through the machine in 11½ minutes. The result was 15 kilos. of wet ribbons (with particles of wood and pith adhering to them as before.) This would be at the rate of 783 kilos. of wet ribbons per day of 10 hours ; or of 575 pounds (avoir.) of dry ribbons in the same period. There is a considerable difference between the results obtained by this machine in the first and second trials. This was also noticeable in the Barbier machine. The construction of these machines evidently does not enable them to cope with stems with leaves attached. On the other hand the Favier machine did better with stems with leaves than those without leaves. This, however, is not a matter of great importance. In the field the leaves could be easily detached during the cutting ; and if not removed then, they would fall off of their own accord after lying in a heap (inducing a slight fermentation) for a few hours.

FLEURY-MORICEAU PROCESS.

Only one process was shown. This was singularly simple, and consisted of steeping the fresh (or dry) stems for a short period in boiling water and removing the ribbons by hand. An open galvanised tank about 6 feet long, 2 feet wide, and about 4 feet deep, filled with water, was raised on bricks (or stones) about 18 inches from the ground over an open fire. When the water had reached boiling point a crate containing 50 to 100 fresh stems was lowered into it (and depending on their age and character) left in it for 5 or 15 minutes. At the end of that time the crate was lifted out, the stems left to drain while another lot was put in. The stems already steeped were then taken up by a couple of workmen and quickly and effectually cleaned by hand. The action of the boiling water had apparently thoroughly loosened the attachment of the cortex to the wood, and ribbons were produced perfectly clean and regular, and apparently without any loss of fibre.

This method was tested in the first trials only. The operation began by placing 18 kilos. of fresh stems in boiling water and allowing them to remain there for 10 minutes. In 36 minutes (or in 46 minutes including the time occupied in immersing the stems) the workmen, apparently not specially trained in the work, produced 5·600 kilos. of excellent ribbons. This would be at the rate of 73 kilos. of wet ribbons per day of 10 hours ; or of 161 pounds (avoir.) of dry ribbons for the same period.

This process, it will be noticed, is of the simplest possible description. The only apparatus necessary is a tank. This tank could easily be moved from place to place in the field, and the wood of the stems after the ribbons are removed would probably furnish most of the fuel necessary. The process can, however, only be utilised in a few special countries where labour is very cheap.

M. Crozat states that ribbons produced by this process can be dried, baled, and delivered ready for shipment at a cost not exceeding 8 to 10 centimes per kilo. (about 85 shillings per ton). In Tonkin it could be done for even less than this.

It will be noticed that the Fleury-Moriceau process follows somewhat on similar lines to that of the Favier process of 1882. In this latter the stems were steamed for some time in a close fitting cylinder. The former is, however, much simpler, and requires absolutely no skilled labour, nor any plant except an open tank, large or small, according to the circumstances of the grower.

The inventors of the Fleury-Moriceau process are evidently of opinion that wherever cheap labour is obtainable it is in every way preferable, in the production of Ramie ribbons, to the best machine. After all, placing the Ramie stems in boiling water is only a modification of the old retting process practised so long by the Chinese, and by means of which probably the China grass of commerce is still produced. In any case the Fleury-Moriceau process deserves to be carefully considered, and especially in its applicability to the circumstances of India. There the ryots might grow Ramie in small areas, prepare the ribbons and sell them to merchants for export, or to a neighbouring factory or *usine*. The steaming process of M. Favier, designed for use under similar circumstances, failed no doubt on account of the restrictions placed on the use of the patent, and the uncertainty of the demand for ribbons. The Fleury-Moriceau process re-opens the question under circumstances much more favourable, and the subject is one which deserves careful consideration wherever labour is sufficiently abundant to permit of ribbons being produced at a price that will compete with machine-cleaned ribbons.

The relative value of the several machines, and of the Fleury-Moriceau process, tried at Paris in 1889, may be gathered from the following tables:—

TABLE 1.—FIRST SERIES OF TRIALS. Green stems, without leaves.

Machine.	No. of Hands employed.	Weight of Green Stems. (Kilos.)	Time employed.	Quantity of Wet Ribbons produced. (Kilos.)	Estimated Quantity of *Dry* Ribbons producible in a day of 10 hours (pounds Avoir.).*
Armand-Barbier -	2	10	6 m.	1·300	96
Favier (No. 1) -	2	10	4½ m.	2·820	276
Michotte - -	2	7	1½ m.	1·000	—
De Landtsheer (large machine).	2	36	2½ m.	10·000	1,763†
Fleury-Moriceau process.	2	18	46 m.	5·600	161

* In preparing this estimate the wet ribbons are calculated to yield one-third of their weight of dry ribbons, and the kilo. is taken as equivalent to 2·204 pounds avoir.

† This large yield of ribbons must be reduced about 20 per cent. on account of the pith and wood lightly adhering to them.

TABLE 2.—SECOND SERIES of TRIALS. Green stems, with leaves.

Machine.	No. of Hands employed.	Weight of Green Stems. (Kilos.)	Time employed.	Quantity of Wet Ribbons produced. (Kilos.)	Estimated Quantity of *Dry* Ribbons producible in a day of 10 hours (pounds Avoir.).
Armand-Barbier -	2	26	10½ m.	1·200	50
Favier (No. 1) -	2	60·350	18 m.	18·100	443
Michotte - -	2	17·400	2½ m.	6·000	—
De Landtsheer :					
(*a.*) Large machine	2	46	11½ m.	15·000	575
(*b.*) Small machine	1	24·400	10 m.	6·500	287

AWARDS OF THE JURY.

As was the case last year, the official report of the jury will probably not be published till the appearance of the December number of the *Bulletin de l'Agriculture*. In the meantime it may be mentioned that the jury, following the rules applicable to the other exhibits at the Exposition Universelle, awarded a gold medal to M. Favier; a gold medal to M. de Landtsheer; and a silver medal to MM. Fleury-Moriceau. These awards, it will be noticed, follow closely the results already detailed above, and they may be accepted as affording a clear indication of the relative value of the several machines and processes submitted to the jury.

To those generally interested in Ramie culture it may be mentioned that the trials of 1889 have proved much more favourable than those of 1888, and the subject is evidently ripening for solution in many directions not thought of before.

This can be best shown by a comparison of the results as follows :—

TABLE 3.—RESULTS obtained in 1889 compared with those obtained in 1888.

Machine.	Quantity of Dry Ribbons producible in a day of 10 hours (pounds Avoir.) working on Green Stems.	
	1888.	1889.
De Landtsheer :		
Large machine - - -	—	1,763*
Small machine - - -	120	287
Barbier - - - - -	71	96
Favier, No. 1 - - - -	—	443
Fleury-Moriceau - - -	—	161

* See note in Table 1.

It will be noticed that the best results obtained in 1888 were at the rate of 120 pounds of dry ribbons per day of 10 hours. This was with the De Landtsheer small machine. In 1889 this machine, with improvements, produced at the rate of 287 pounds of dry ribbons (more than double the quantity) for the same period. With the large machine (make due allowance for the pith and wood lightly adhering to the wet ribbons) the returns of dry ribbons would be at the rate of over half a ton per day.

OTHER MACHINES AND PROCESSES.

Before closing this report it is desirable to pass under review a few of the machines and processes not represented at Paris which have recently come into notice in this country and elsewhere. In the absence of carefully arranged public trials under the control of men thoroughly conversant with the subject, it must be understood that it is impossible to express an authoritative opinion as to the merits of such machines and processes. They are noticed here solely for the purpose of furnishing a more or less complete record of Ramie experiments which have been undertaken during the present year, and of affording information that otherwise would not be available to persons interested in the subject in India and the Colonies.

THE DOTY SYSTEM.

A system brought forward by Captain Doty (inventor of the Doty light) is based on the assumption that no decorticating machine, however meritorious, will fully meet the requirements of Ramie planters, who are obliged, with the aid of unskilled labour, to deal with a large quantity of green Ramie stems within a short time. Captain Doty is of opinion that where labour is cheap women and children might be employed to strip the fibre from the freshly cut stems by hand, and leave 80 per cent. of the weight of the crop (the wood) on the field. Under such circumstances the ribbons alone would be carried away, either to be dried for exportation or to be treated at central factories or *usines*, firstly by a process of fermentation, and subsequently by chemical cleaning and washing to produce filasse ready for spinning.

"Nothwithstanding," says Captain Doty, "the failures of all previous "attempts to deal with this fibre by fermentation it is almost self "evident that a fermentive treatment is the only possible solution of "the problem. No mechanical process that can be devised will ever "eliminate the gum by which the fibres are cemented together, and "without the elimination of the gum the division and sub-division of "the fibres necessary to produce a delicate filasse can never be "obtained."

A trial of the Doty system recently took place near Rome, and a report thereon was prepared by Signor G. Trombetta, Secretary to the Italian Ministry of Agriculture, and published in the *Bolletino di Notizie Commerciale*, Sept. 1st, 1889, pp. 689–690. In this report it is stated that the system is based on the disintegration to which the gummy substance in the Ramie ribbons is exposed by an acid fermentation. The ribbons are first of all tied up in bundles and placed in fermenting vats, where they remain for about a week. They are then taken out and washed. Afterwards they are boiled with certain chemical ingredients for two hours, washed in cold water, and dried and combed. The report concludes by stating that the fibre was in some cases of unequal character as regards colour and quality, due to the provisional nature of the appliances used; but the results obtained on a small scale gave hopes that with larger quantities and suitable boiling vessels, properly closed, and with proper machinery to agitate the mass, the fibre would be obtained in a more satisfactory condition.

THE TILL MACHINE.

As far as can be gathered from a description privately communicated by the inventor (Mr. C. G. Till), this is a large machine, weighing nearly two tons, driven by steam-power, and costing about 150*l*. It is furnished with rollers and beaters, about 3 feet long; it has a continuous action, similar to the Favier and De Landtsheer (large) machine, and takes about 36 stems of green or dry Ramie at a time. It has not yet been fully tested for the out-turn of ribbons, but the inventor estimates that it will clean between half a ton and a ton per day.

PAPLEUX SYSTEM.

In consequence of letters which appeared in the *Melbourne Argus* at the time of the Centennial Exposition held at Melbourne, inquiries were addressed to Kew respecting the Papleux system for cleaning Ramie.

This system was at one time in operation by Messrs. W. H. Spencer & Co., of Hitchin, Herts, but is now abandoned. Recent experiments have been carried on with a formula invented by Messrs. Spencer themselves, and by means of this they have been successful in preparing small samples of fibre of excellent quality. It is probable that Messrs. W. H. Spencer & Co. will eventually be able to treat Ramie ribbons on a large scale and convert them by mechanical and chemical means into filasse or finished yarns. It is understood, however, that at present the process is not available to the public.

PLAISIER MACHINE.

A machine, the invention of a Dutch engineer named Plaisier, is the subject of an extended notice in *de Indische Mercur* of the 19th January 1889, by Van Gorkhom. This machine, driven by an engine of 1½ horse-power, has been successfully worked at Deli, in Sumatra, for some months, and it is stated to treat 5,000 kilos. of green stems per day, yielding 125 to 150 kilos. of ribbons.

GENERAL REMARKS.

In the Diplomatic and Consular Reports, Series 1889 (p. 37), there is given an account of an experimental planting of Ramie at a Colony in the Province of Santa Catharina, Brazil. This Colony obtained the first prize for a collection of Ramie fibres at the Antwerp Exhibition.

In the same Reports, No. 525, on the trade of Hankow, attention is drawn to the facilities which exist there for procuring and manipulating Rhea fibre on a large scale. The Consul adds, "it would give me much "pleasure to know that a good business in this article could be started "here. But until machinery for preparing it is perfected, exports "would be premature."

On the 23rd August last a despatch was forwarded by the Foreign Office from the Acting Consul at Carácas, dated the 25th July 1889, giving an acconnt of the formation of an Italo-Venezuelan Company to plant Ramie on a large scale. Experimental plantations had already proved so successful that machinery had been imported to begin the operation of preparing the fibre.

As described in the *Kew Bulletin*, 1888, pp. 145–149, a Ramie factory established in Spain, at Torroella de Montgri, Gerona, in the neighbourhood of large Ramie plantations, appear to have proved successful. This factory employed the Favier decorticating machines. In a letter dated the 19th October 1889, Mr. Wooldridge, Her Britannic Majesty's Consul at Barcelona, informs me that "Ramie is still being "cultivated with important results near Torroella, and that they con- "tinue to use the Favier machines, which are believed to be the most "perfect machines of their kind."

It may be mentioned that these factories are being worked privately, and probably the methods and machinery are not available to the public, except under a special arrangement with M. Favier. The fibre prepared is utilised in France, and does not come into general commerce.

In British tropical possessions, both in the East and West Indies, Ramie is being grown experimentally, in the hope that some machine or process will eventually be produced to enable the fibre to enter into commerce and become a regular article of trade.

The results of the Paris trials last year naturally discouraged Ramie growers, and little if any extension of Ramie planting has taken place since that time. The results of the recent trials will no doubt be closely scanned by those interested in the subject. The first aim of planters should be to produce ribbons of good quality at the lowest possible cost. In other words, planters have to solve the question how to produce Ramie ribbons, that is, to secure the complete removal of the cortex (which contains the fibre) from the green stems, at such a cost as will prove remunerative to themselves and at the same time allow sufficient margin for the cost of converting these ribbons into filasse ready for the spinners. Hitherto the want of success in the production of ribbons has apparently been the only obstacle to the development of a Ramie industry. And probably on this account the Paris trials were wholly devoted to the production of ribbons and not of filasse. The conversion of ribbons into filasse is a subject believed to be more easily dealt with. In fact there are several systems exclusively devoted to this department which appear to accomplish it. Some machines, it is true, have attempted to produce filasse by a single process from the green stems. The result has not been satisfactory, and it is very unlikely that this can be done with a plant like Ramie, in which the individual fibres are so completely immersed in gummy matter. Hence the subject has been divided into two parts. The first is concerned alone in the removal of the fibre in the form of ribbons from the green stems, either in the fields or in their immediate neighbourhood. The second is devoted to the treatment of these ribbons and in their conversion by chemical and other processes into filasse, or fine white silky fibres ready for the spinner. The first process will naturally take place where the plants are grown, in the Colonies or elsewhere, and machines like those of Favier and De Landtsheer, or processes like that of Fleury-Moriceau, may be adopted according to the special circumstances of the planter. Sufficient progress has now been made in the working of these machines and processes to justify careful trials being undertaken with them both in India and the Colonies. If these machines or any others that may be forthcoming prove entirely satisfactory, and ribbons can be produced at a low initial cost, the question of their conversion into filasse is one which will naturally come into prominence. The conversion of ribbons into filasse will very probably, at first at least, take place in Europe, where chemicals and skilled labour are the more readily available. In some countries it may be found advisable later on to establish central factories or *usines* on the spot (to save freight charges on the ribbons), and ship only the filasse to Europe. In any case once a Ramie industry is well started, there can be no doubt numerous countries will seek a share in it, and only those possessing special advantages for the growth of the plant, a supply of cheap labour, and good facilities for transport and shipment can hope to make it a success.

The best market for Ramie at present appears to be France. What little is imported into this country, in the form of China grass or Rhea, is bought up for the French market. In the Monthly Circular of Messrs. Ide and Christie for the 15th October 1889, China grass is quoted "quiet" at 31*s*. to 35*s*. per cwt.; and Rhea, "no business," at 14*s*. to 10*s*. per cwt.

With regard to what is known in commerce as "China grass," this is hand-cleaned fibre shipped usually from Chinese ports. It arrives in this country in small parcels, the yearly importation being only about 100 tons. It is nearly all taken up by continental buyers. Rhea is the term applied to machine-cleaned fibre, generally in the form of ribbons or half-cleaned stuff. The price is much less than China grass, and in case of large shipments would probably not exceed about 7*l*. or 8*l*. per ton. It is important therefore for Ramie planters to aim at the production of ribbons at a cost not exceeding about 4*l*. or 5*l*. at the port of shipment. Important elements in such production would be to plant Ramie only in places where the soil and climate will allow of three or four crops to be reaped per annum; where labour is very cheap and abundant, and where good facilities exist for transport and shipment.

D. MORRIS.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 36.] DECEMBER. [1889.

CXXII.—POISONING FROM TURNSOLE IN PERSIA.

(*Chrozophora tinctoria*, A. Juss.)

The following correspondence has recently taken place respecting the poisonous properties of the Turnsole (*Chrozophora tinctoria*, A. Juss. Tent. Euphorb. 28, t. 7, f. 25). This is an annual plant, with prostrate habit and softly clothed with stellate tomentum. It is found in the Mediterranean region, and extends eastward to Afghanistan and India. The poisonous character of the plant does not appear to have been dwelt upon, but there can be little doubt, from the observations of Mr. Casson in Persia, that under certain circumstances it is deadly in its effects on human life, and this fact cannot be too widely known:—

Mr. Casson to Royal Gardens, Kew.

Her Majesty's Legation, Tehran,
July 8, 1889.

Sir,

I have the honour to enclose specimen of a plant, known by the Persians as Tatuleh, from the eating of which I found six persons, varying in age from 65 to 8 years, exhibiting marked symptoms of

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acute poisoning, and all of whom, at intervals varying from 36 to 72 hours, actually died. The symptoms they exhibited were severe jaundice, abdominal pain, severe vomiting of bilious character, dilation of pupil, bleeding from nose, constipation, bloody urine tinged deeply with bile, and more or less stupor. All died in a comatose state. If you could give me any information as to whether the plant is known in Europe or any other particulars I should be greatly obliged, as I feel that the case is one of sufficient toxicological interest to be reported to the Medical Societies at home. It appears that the plant is known by the Persians to be poisonous to man, and in this unfortunate instance was gathered by an ignorant woman in mistake for another plant which it much resembles, and which is used in this country as an article of food. In any case I have thought it worthy of bringing under your notice. I may add that all who ate of the plant died.

I have, &c.
(Signed) J. Hornsey Casson,
Physician to Her Majesty's Legation
in Persia.

To the Director of the
Royal Botanical Gardens, Kew.

Royal Gardens, Kew, to Mr. Casson.

Royal Gardens, Kew, October 14, 1889.

Sir,

I have the honour to acknowledge the receipt of your letter of July 8th, transmitting specimens of a plant, known by the Persians as Tatuleh, which you inform me has proved fatal to six persons who had eaten it by mistake.

2. The plant belongs to the natural order *Euphorbiaceæ*, which abounds in acrid and poisonous species such as the Physic nut (*Jatropha Curcas*), Croton oil (*Croton Tiglium*), and Manchineel (*Hippomane Mancinella*). It has been identified as *Chrozophora tinctoria*, a plant indigenous throughout the Mediterranean basin. I have failed to find any record of its having been found to be fatally poisonous. Lindley, however, states in his Flora Medica (p. 179) that it is "an acrid plant, "with emetic, drastic, corrosive properties. Its seeds, ground into "powder and mixed with oil, are employed as a cathartic medicine. "It is cultivated for the deep purple dye called Turnsole which is "obtained from it."

3. An account of this product is given by the late Daniel Hanbury. F.R.S., in the Pharmaceutical Journal (1849–50, pp. 308–9). It is termed Turnsole rags, *Tournesole en drapeaux*, to distinguish it from Litmus or *Tournesole en pains*, the origin of which is different. The juice of the plant is expressed, and, at first dark green, becomes purple on exposure to the air. Turnesole rags are pieces of coarse sacking, which are soaked in the juice and then dried. The manufacture of Turnsole has been carried on in the south of France from an early period. At the time Hanbury wrote they had fallen into disuse everywhere except in Holland, where it was believed their only use was to colour the exterior of cheese.

I am, &c.
(Signed) W. T. Thiselton Dyer.

J. Hornsey Casson, Esq., M.R.C.S.,
H. M.'s Legation, Tehran, Persia.

CXXIII.—MUSSÆNDA COFFEE.

(*Gærtnera vaginata*, Lam.)

Under the name of *Mussænda borbonica*, M. Lapeyrère, a French apothecary, has described in the *Bulletin Bimensuel de la Société Nationale d'Acclimitation de France*, 1888, pp. 285–300, a plant found at Réunion, which he believed would yield a commercial substitute for coffee. From specimens of the seeds forwarded to Kew by the Foreign Office, and from other information obtained on the subject, it appears that the plant in question, described as a new species, was not a *Mussænda* at all, but a well known member of the natural order *Loganiaceæ.* It has been identified at Kew as *Gærtnera vaginata*, Lam., found in mountain woods in Mauritius and also in Bourbon and Madagascar. The two pyrenes found in the fruit, although smaller, have a superficial resemblance in form and texture to true coffee "beans." They are, however, marked with radiating lines on both surfaces, and in this respect, and in the dull-reddish colour, they may be readily distinguished.

On the subject of Mussænda Coffee the Foreign Office has communicated to this establishment the following correspondence, giving the result of inquiry made at Réunion by Mr. C. St. John the British Consul.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, June 26, 1889.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of Kew Gardens, the accompanying copy of a despatch respecting the *Mussænda* or Wild Orange.

Samples of the seed which Mr. St. John reports that he has forwarded will be sent to you upon their receipt at this office.

I am, &c.
(Signed) JAMES FERGUSON.

The Assistant Director,
Royal Gardens, Kew.

[Enclosure.]

MR. CONSUL ST. JOHN to FOREIGN OFFICE.

MY LORD, Réunion, May 14, 1889.

As an article has appeared on page 12 of the "British Mail" of February last, relative to a shrub commonly called Mussænda, and several letters have been addressed to this Consulate for information on the subject, I beg to offer a few observations and information derived from a reliable source.

Unfounded rumours relative to the merits of the shrub have caused alarm as to the future of the coffee and chicory trade; but nothing of the kind, so far as Réunion is concerned, need be apprehended. The information given in the "British Mail" as to the quantity of Mussænda produced in this Colony might be misleading.

Some 18 months ago a chemist in search of notoriety spread a report that the berry of this shrub could replace coffee and chicory, and the question was much talked about and discussed, but all interest in the subject soon ceased.

The real name is Gærtnera. It rises to a height of 10 feet, has but few leaves, and the branches are wide apart. The berry, when gathered, is peeled, and then much resembles the coffee berry, though smaller. In fragrance it is inferior to coffee, and in colour to chicory.

The shrub at present found in the forest is not plentiful, and only bears at the extreme end of the branches, instead of all along. The yield is far less than that of the coffee tree, and the picking more expensive, that is to say, about 1*s.* the pound. It is much doubted by reason of its inferiority that Mussænda could ever compete with coffee and chicory, even if it were cultivated.

From an inquiry made at the Chamber of Commerce of St. Denis on the subject, the correctness of the above statement is fully established.

I have, &c.
(Signed) C. St. John.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

The real value of Gærtnera seeds as a coffee substitute entirely depends on whether or not they contain caffeine.

M. Lapeyrère, in his paper above cited (p. 292), states that the unroasted beans contain ·30 to ·55 per cent. of this substance, unroasted coffee beans containing ·80 to 1 per cent. While there would be nothing improbable in a plant belonging to the same family as coffee, *Rubiaceæ*, containing caffeine, it is quite the reverse in the case of a member of the *Strychnos* family, *Loganiaceæ*. A sample of the seeds was therefore submitted to Mr. Wyndham Dunstan, Professor of Chemistry to the Pharmaceutical Society of Great Britain, who has kindly furnished the following report, and the results of his examination.

Professor Dunstan to Royal Gardens, Kew.

Pharmaceutical Society of Great Britain,
17, Bloomsbury Square, W.C.,
Research Laboratory, October 21, 1889.

Dear Mr. Dyer,

I have examined the chemical constituents of seeds of *Gærtnera vaginata* which you sent me.

A special search was made for caffeine or any other similar alkaloid. One hundred and fifty grains of the finely powdered seeds were mixed with fifty grains of magnesia and made into a paste with water. The mixture was thoroughly dried and powdered. The powder was successively exhausted with boiling chloroform, boiling alcohol, and boiling water, and the residue left by the evaporation of the solvents was carefully examined for caffeine, but not a trace of this, or indeed of any other alkaloid, could be detected.

I propose to communicate to the Pharmaceutical Society, at its next meeting in November, further details about these and other experiments I have made. They prove beyond question that no caffeine is present, and therefore that the seeds cannot be regarded as a proper substitute for coffee.

I am, &c.
(Signed) WYNDHAM R. DUNSTAN.

It is clear, therefore, that as regards essential composition, Mussænda Coffee is of no more value as a coffee substitute than chicory, date coffee, acorns, and a variety of other substances which have from time to time been used or recommended.

CXXIV.—FOOD GRAINS OF INDIA (*continued*).

(*Dendrocalamus strictus*, Nees.)

In continuation of the investigations undertaken by Professor A. H. Church, F.R.S., respecting the alimentary value of the chief food grains of our Eastern Empire (*Kew Bulletin*, December 1887, p. 7, and *l. c.* 1888, p. 266), supplementing those given by the same author in the *Food Grains of India* (London: Chapman and Hall, 1886), there is now given an analysis of the grain of the Male Bamboo (*Dendrocalamus strictus*, Nees). This grain was received at Kew in August last from the Agricultural and Horticultural Society of India.

The Male Bamboo* is in many respects an interesting plant, and a few words on its characteristics and distribution may precede the results of the chemical analysis of the grain.

Dendrocalamus strictus, Nees, (Bambusa stricta, Roxb. Fl. Ind. ii. 193), is described and figured by Brandis, *Forest Flora* of N. W. and Central India, p. 569, tab. lxx. It is a middle-sized, generally deciduous, bamboo. The stems have a small central cavity or are entirely solid. They are closely packed in dense clumps, and the stiff leafless branches near the base assume a spinose character. The joints are 12 to 18 inches long and 1 to 3 inches in diameter. The leaves are exceedingly variable in size, from 3 to 9 inches long, and a quarter of an inch to 1 inch broad. The caryopsis (fruit) is brown, shining, ovoid, a quarter of an inch long. This bamboo is widely spread and very common throughout India and Burma. In the Panjab it is confined to the sub-Himalayan tract. It extends to Java, but not to Ceylon. "The "species occasionally flowers gregariously, but generally single stems "only or single clumps are found in flower" (Gamble). The stems that have flowered die after the seed ripens.

Sir Dietrich Brandis, in the work already cited, states that the stems of the Male Bamboo attain to 20 or 40 feet in the Panjab, in South India to 30 to 50 feet, while on moist ground they may attain to 100 feet. The stems grow to their full height in a few weeks at the commencement of the rains; in the Panjab they do not, however, harden fully during the first year. These stems are strong and elastic; they are much used for roofing, basket and wattle work, and they make excellent lance-staves. In the bamboo forests of the Panjab and the North-West the different sizes and descriptions of this bamboo are classified under a multitude of names.

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* But why Male it is difficult to say. In the structure of the flower this species possesses nothing exceptional that would account for the name, and it bears seeds freely.

The analysis of the grain made by Professor Church is as follows:—

Dendrocalamus strictus.

The grain of this bamboo, after separation of the husk, gave, on analysis, the following results in 100 parts:—

Water	13·9
Albuminoids	11·5
Starch, &c.	66·3
Oil	1·4
Fibre	5·9
Ash	1·0

It should be stated that the above per-centage of albuminoids has been calculated on the usual supposition that the whole of the nitrogen present in the grain exists in the albuminoid form. But the coagulable albuminoids, as estimated by the "phenol-method," amount to 10·6 per cent. only—a difference which is not an unusual one. The ratio of albuminoids to carbohydrates plus the starch—equivalent of the oil—will then be 1 : 6⅔ instead of 1 : 6. These figures are very near those given by *Bambusa arundinacea*[*] and *B. Tulda*,[†] which the present species closely resembles in chemical composition and food-value. Its husked grains are, however, smaller than those of *B. Tulda*, but are larger than those of *B. arundinacea*, as shown in the following table:—

Bambusa Tulda	70	husked fruits	weigh	100 grains.
Dendrocalamus strictus	222	,,	,,	,,
Bambusa arundinacea	300	,,	,,	,,

There is more oil, but also more fibre in this grain than in that of the other bamboos to which reference has been made.

A. H. C.

CXXV.—RAMIE OR RHEA.

(*Boehmeria nivea*, Hk. & Arn.
Boehmeria nivea, var. *tenacissima*, Gaud.)

The report on the results of the trials of machines and methods for decorticating Ramie stems, held at Paris on the 23rd September 1889, was published in the *Bulletin* for last month (p. 268).

It is evident from this report that considerable progress has been made towards a solution of the problems involved in the treatment of Ramie fibre, and it remains for those interested in the subject in India and the Colonies, to initiate locally such further experimental trials of machines and methods as will determine, with an abundance of green stems at hand, whether Ramie fibre can now be made available for commercial enterprise.

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[*] Food Grains of India, p. 102.
[†] Kew Bulletin, December 1887, p. 8.

The Foreign Office has communicated the following letter addressed to Lord Lytton, Her Majesty's Ambassador at Paris, by Mr. J. A. Crowe, C.B., Commercial Attaché for Europe, respecting the results of the trials of Ramie fibre machines :—

My Lord, Paris, October 29th, 1889.

With reference to Lord Salisbury's Despatch (No. 124 of the 23rd instant), on the subject of the awards and official reports in the matter of Rhea fibre-cleaning machines at the Universal Exhibition, I have the honour to enclose copies of the general list of awards which has just been made public, to which I have added a list of the special awards for decortication of Ramie fibre.

The [official] reports which have been asked for will probably not appear, so I hear from Mr. Berger, till some time next year.

I have, &c.
(Signed) J. A. Crowe.

[Enclosure.]

Exposition Universelle, 1889.

Concours de Décortiqueurs pour la Ramie.

First Prizes.

P. A. Favier, Société la Ramie Française, 14, Rue Saint-Fiacre, Paris [for machines for treating Ramie stems].

Norbert de Landtsheer, 2, Place des Batignolles, Paris [for machine for treating Ramie stems].

Second Prize.

Ch. Crozat de Fleury et A. Moriceau, Villieurs-le-Bel, Seine-et-Oise [for process for the treatment of green Ramie stems in the field].

In regard to M. Favier's machines, which were awarded a first prize for cleaning green Ramie stems, this gentleman, well known as having devoted during the last 10 years much time and attention to the development of Ramie industry in France, Spain, and other countries, has forwarded further particulars, of his machines to supplement those already given in Mr. Morris's Report :—

M. Favier to Royal Gardens, Kew.

Paris, 14, Rue Saint-Fiacre,
11th November 1889.

Sir,

I have duly received a copy of the *Kew Bulletin* of miscellaneous information, which you have been good enough to send me, and I beg to thank you for the compliment.

Since the trials upon which you have reported I have added some improvements to my machine, to prevent the ribbons from being entangled in the rollers, and on the 23rd October I carried out further experiments in the presence of numerous people interested in the subject.

I passed through my machine, with two workmen, 100 kilos. of green stems, more or less with leaves, in 12 minutes. This is equivalent to 5,000 kilos. of green stems (and assuming the rate of yield at 5 per cent. of dry ribbons) to about 550 pounds (avoir.) of dry ribbons per day of 10 hours. With the full complement of four workmen necessary to do justice to the machine it will work off 7,500 kilos. of green stems, and give a return equivalent to 775 pounds (avoir.) of dry ribbons per day of 10 hours. The ribbons, as you saw at Paris, are perfectly free from pith and wood.

The intricate nature of my machines, to which you allude, is only apparent. They consist really of repetitions of similar parts of crushers and rollers, weighing 10 or 12 kilos. each, so arranged that they can be easily taken in and out. The work of putting up these machines is very simple, and they can be easily regulated by anyone.

The little power required to drive my machines (three-quarter horse-power) clearly indicates that the several parts are not heavy to move, and that there is really nothing in them cumbersome or involving strain on the fibre as in other Ramie machines hitherto produced.

* * * *

The cost of my machine (for treating green Ramie stems) will probably be 80*l.* to 100*l.*, with a royalty, which is not yet fixed.

I have, &c.
(Signed) P. A. Favier,
Directeur de la Société "La Ramie Française."

D. Morris, Esq.

At the date of the publication of Mr. Morris's report, the demand for Ramie ribbons in the London market was so slight that the prices quoted may possibly have offered little inducement for embarking in Ramie growing in the Colonies.

The information received from Messrs. Ide and Christie, in a letter dated 29th October 1889, was as follows:—

"There is very little inquiry for ribbons at present, and we do not " think they would fetch more than 8*l.* to 10*l.* per ton. We may " confirm our circular report by simply saying 'Nothing doing.'

"There are some parcels of highly prepared Ramie in London just " now, some of Indian and some of English manufacture, the values of " which range from 28*l.* to 50*l.* nominally. Those are on sale, but the " demand is almost *nil.*"

Since that time, however, it appears that a considerable improvement has taken place in the price of Ramie ribbons, and Messrs. Ide and Christie, in a letter dated the 5th November last, were able to report as follows:—

. . . . "During the past week some considerable investment " has taken place in Ramie; the whole stock in London of ribbons has " been sold at prices ranging from 14*l.* to 16*l.* per ton, and a good " deal of this was out of condition and somewhat perished. We believe " that this stock has gone into consumption by English manufacturers. " There is an enquiry for further parcels, and we are now disposed to " think that the bases of a real trade in the article are in process of " formation. At least we feel sure there are buyers in the market of " 100 tons of ribbons up to 12*l.* per ton, and we could not perhaps " have said this a few months ago."

In Messrs. Ide and Christie's monthly circular, dated 15th November, it is stated :—

"*China Grass.*—Improved inquiry, and a large turn over has occurred " from 30*s*. to 34*s*. [per cwt.].

"*Rhea.*—Stocks of raw ribbons cleared out up to 16*s*. [per cwt.]. " Market bare, with plenty of inquiry."

It may be mentioned that the remarks on the Papleux system, which appeared at p. 276, may be supplemented by the information that Messrs. W. H. Spencer & Co. are associated with The Boehmeria Company, Limited, at Hitchin, Herts, formed for the purpose of converting Ramie and other textiles into yarns.

CXXVI.—COOL CULTIVATION OF TROPICAL AND SUB-TROPICAL PLANTS.

Horticulture is essentially an empirical art. Botanical science can afford but little *à priori* information as to the cultural conditions which any given plant will require or will tolerate; these for the most part can only be found out by trial and experience.

There can be no doubt that owing to this circumstance very great mistakes are made in the treatment to which newly introduced plants are subjected even in botanic gardens. This is peculiarly the case with plants coming from the tropics, as in a large proportion of cases we have no exact knowledge of the altitude at which they grow, or the range of temperature to which they are exposed naturally. It is only necessary to reflect for a moment on the various conditions of vegetation presented in the case of Kilima Njaro, a snow-clad mountain close to the equator, to see that a plant from the tropics may be suited to any conditions from those that are really tropical to those that are even rigorously alpine. But too often there is nothing, in the absence of exact information as to the conditions under which a plant actually flourishes, to give any clue to these conditions. Take the case of Brazilian Tree Ferns. There is nothing in habit or botanical characters to show which of these require cool and which hot treatment; and it is not till one has succeeded in killing a good many by the latter that one begins to wonder whether the former might not be worth trying. And yet it is hard to rid oneself of the prepossession that plants from the tropics must be best treated by heat and moisture and that there is something almost irrational in giving them anything else. Mr. H. J. Veitch, in an able paper recently published in the Journal of the Royal Horticultural Society, has shown by what slow steps cool treatment for orchids has been gradually established. "Epiphytal orchids," he remarks, "were " poured into the country in a continually increasing stream, only too " often to tantalise the purchasers with a sight of their lovely flowers " and curious forms, and then to languish and die. For more than " half a century England was, as Sir Joseph Hooker once observed, " 'the grave of tropical orchids.'"

It might have been expected that the same thing would be found to be true of other kinds of plants, and in some measure this is found to be the case. For some years past I have been compelled to scrutinise the collections in the Palm House at Kew in order to see where space could be found for the development of the profusion of new and interesting species of palms which we have now accumulated. And I have not hesitated to transfer to the Temperate House plants which I thought would probably endure a lower temperature. I did not expect to find, as has proved to be the case, that many of them luxuriated in the change. The Temperate House, as its name indicates, had previously been dedicated to the plants of warm temperate countries, which were incapable of surviving our English winter in the open air. It appeared to me that its interest might be greatly enhanced by introducing freely into it sub-tropical types of vegetation.

Now, nowhere have plants of this kind been made the subject of experimental cultivation on so vast a scale as on the Riviera. The exceptional conditions of its climate have tempted persons possessed of horticultural tastes and considerable wealth to try freely in the open air a great variety of plants, ordinarily in Europe only to be seen in cultivation under glass. It seemed obvious that a great deal might be learned by taking stock of the results which had been actually accomplished, especially in private gardens. I therefore applied to the First Commissioner of Her Majesty's Works and Public Buildings for leave to send the able Assistant Curator of the Royal Gardens, Mr. Watson, to the South of France to report upon what he was able to observe. To this the Board assented; and the result of Mr. Watson's mission is contained in the following pages. They are published in the hope that they may be useful to others beside the staff of the Royal Gardens.

W. T. T. D.

Kew, 25 November, 1889.

The gardens of the Riviera have become famous for the large number of exotic plants, many of them even tropical, which are cultivated there with astonishing success in the open air. Probably in no other part of Europe are the conditions so favourable to real and varied sub-tropical gardening as in that narrow strip of country which extends along the northern border of the Mediterranean from Hyères to Genoa.

Reports of what these gardens contained have appeared from time to time in horticultural and other journals, but these were either too discursive or fragmentary to enable one to form any correct idea as to what was grown and how it was accomplished. It was therefore decided that I should visit some of the principal gardens of the Riviera for the purpose of seeing what succeeded best in somewhat similar conditions. This I accordingly did in the latter part of October last, visiting as many gardens as possible between Hyères and Mentone in the fortnight at my disposal.

The following notes are intended to serve as a report on the most striking of the many tropical and sub-tropical plants noted during this journey.

First, however, it may be worth while saying a few words as to the climate and other conditions peculiar to this portion of the South of France. In the Journal of the Linnean Society, Vol. XVIII., p. 135 (1880), is a paper by Professor Allman, M.D., F.R.S., on the natural vegetation of the Riviera, in which one gets an excellent idea of the characteristic features of those parts which I visited. I take the liberty to quote from this paper the following paragraphs:—

"Nowhere in Europe is there a region which, in winter and spring, basks
" under the rays of a more genial sun, where its mountain barriers more
" thoroughly defend it from the icy winds which sweep over the unpro-
" tected plains of the north; and when the season of rains is at an end,
" there spreads over all this sunny land an atmosphere of absolute
" transparency; while away upon its extreme southern boundary lie the

" waters of the Mediterranean, flowing round wooded crags and " picturesque headlands, and gleaming with an intensity of blue ap- " proached by that only of the cloudless sky which stretches over all.

" When we seek for the conditions which give to the flora of the " Western Riviera a character so essentially its own, we find a climate " remarkable for the mildness of its winters and the high temperature " and dryness of its summers. It is thus neither a purely insular nor a " purely continental climate; for the cool summers and the rigorous " winters of the latter are here equally absent.

" No less peculiar is the distribution of rain throughout the year. " The season of rain is confined to the winter and spring months, while " the summer is, as a rule, absolutely rainless.

" With the most important elements of climate thus distributed, a " well marked influence must be exerted in determining the periods of " active vegetation. After the winter rains have supplied the humidity " essential to the perfect development of vegetation, there bursts upon " the whole country with the coming spring a richness of foliage and of " blossom as beautiful in its forms and in its colours as it is marvellous " in its suddenness. And then, when spring is succeeded by the hot " rainless summer, vegetation becomes arrested, and the freshness of " the spring landscape is gone; for even the evergreens become dull " and lustreless under the increasing heat and aridity of summer."

The annual rainfall in most of the Riviera stations is about the same as that of Greenwich, viz., 25 inches. The whole of this rain, with the exception of an occasional thunderstorm in summer, falls between September and April. The mean winter temperature (November, December, and January) is about 47° Fah. Occasionally the thermometer goes down to freezing point, and sometimes, though rarely, four or six degrees of frost are experienced. This occurred in Cannes last year, when some of the more delicate plants were injured by the cold. In the gardens at Villa Valetta several palms, cycads, and ferns were pointed out as having been injured by the cold of last winter. These will be referred to again. The same amount of cold was felt at Nice, where, in the gardens of the Floricultural Society, many plants were damaged by the frost. In 1887 no less than 11 degrees of frost were experienced in this garden, when many plants, usually hardy there, were killed. Some interesting particulars in regard to the effects of a low temperature on various plants were communicated by the manager of these gardens; these will be given under the respective plants in the list which follows. In Mentone the thermometer rarely falls below freezing point. " Two or three times in the winter the thermometer goes down for a " night or two to 38°, 36°, 34°, or even to 30° in exposed situations" (Bennett).

The same circumstances which make the winter temperature of the Riviera comparatively high have a like effect on the temperature in summer. Gardeners and others, who are there all through the summer, find the temperature often very trying. The fierce heat of the sun, untempered by wind, and the excessive drought, make good gardening very difficult. Many of the plants, large specimens as well as small, require daily drenching at the roots. It is impossible to keep a turf of any kind, the beautiful stretches of green grass which are to be seen in the winter being the results of annual sowings in autumn. At this time the ground intended for grass is dug over and trodden down very firmly, otherwise the heavy rains would wash it into disorder. The grass I was told is entirely rye-grass, and the best seed is reputedly Scotch. It is sown thickly and kept watered until the rains come. Some plants were pointed to as being crippled by the excessive sun-heat in summer.

One of these was *Cycas revoluta*, the leaves of which were scorched. This is one of the commonest, in fact the only common species of cycad which we saw, and very few were healthy. The following tables, copied from Dr. Bennett's book "Winter and Spring on the Shores of the "Mediterranean," will afford some idea of what the summer heat is like in some of the stations of the Riviera :—

——	Mean Temperature of Seasons.			
	Winter.	Spring.	Summer.	Autumn.
Mentone	49·5	60·	73·	55·6
Toulon	43·30	53·70	74·30	59·
Genoa	44·57	58·60	75·03	62·94
Nice	47·82	56·23	72·26	61·63
* Ceylon (Hill districts)	69·30	70·78	69·54	71·29
Madeira	60·60	62·36	69·56	67·30
Port Jackson (N.S.W.)	54·62	63·45	70·93	64·03
Paris	38·43	50·40	64·47	52·30

* For comparison.

In attempting to account for the successful cultivation on the Riviera gardens of so many plants which have hitherto been believed to be distinctly tropical in their requirements, the extraordinary summer heat and sunshine experienced there must be considered as having a great deal to do with it. A plant which makes its growth under such favourable conditions is better able to withstand the trials of a low temperature than one which has been less favoured. This is a well-known fact in horticulture. Again, the length of the cold season is so very short, that little harm can come to plants which are so abundantly favoured in other respects. It is only actual frost that does permanent injury to vegetation. In England a tropical plant may be grown in a low temperature several years before it becomes severely injured, although exposure to a degree or two of frost would probably kill it.

The natural soil of most of the gardens visited is very porous, being formed of crumbled limestone and sandstone. When wet, it is soft and clay-like, but it soon drys and is then not unlike what gardeners know as a mixture of light loam and sand. It is considered poor garden soil, but by copious and frequent supplies of rich manure whatever deficit the soil may have is abundantly made up. In all the best gardens the use of manure is what in England would be considered excessive. Trenches are opened during the summer all round the specimen trees and shrubs, and into these are poured cesspool manure, none of which is ever wasted. I was told that a cartload of this was not considered too much as an annual supply for a large palm. The gardens as a rule are not kept dressed during the summer, most of the owners being at that time elsewhere. This enables the gardeners to perform the rough work, such as manuring, trenching, &c., with thoroughness and ease. Watering is at this time a heavy task. The gardens are mostly on steep slopes or terraced, consequently the water drains away quickly, so that unless the soil is frequently drenched the vegetation would soon suffer. This circumstance must favour those plants which are impatient of 'sourness' or stagnation at the root. Of course many of the plants cultivated on the Riviera would not thrive if planted in a soil which is principally of limestone formation. Such plants as azaleas, camellias, many Australian trees and shrubs and others which require a peaty soil, can only be grown in beds specially prepared for them. In Mr. Hanbury's garden at Mentone there are hundreds of these peat-loving plants, most of them in good health. The porousness of the natural soil will also be favourable to these, as peat so soon decomposes and becomes putty-like unless well drained.

All these gardens are within a short distance of the Mediterranean. This sea contains an unusually large proportion of salt in solution. I was surprised therefore to learn that the effects of the salt are not appreciable in the gardens, no plants appearing to suffer from it. Having seen and heard much of the injury done to plants growing near the sea by salt blown up during windy weather, I naturally expected to see signs of its ill-effects in the Riviera. Probably cases would have been found had further inquiry been made, but it is a fact that I neither heard of nor saw any.

Among the plants which have been introduced, the palms form by far the most prominent feature in the towns of the Riviera. The beauty of many of the gardens is largely due to the effect produced by groups or large specimens of palms of various kinds. In some of the towns and especially Hyères, the streets are planted with *Phœnix dactylifera*, the common Date, its tall straight stem, 30 or more feet high in some instances, crowned with a huge head of grey-green arching leaves. The effect produced is monotonous and rather depressing, but it could be easily improved by the addition of some such trees as Eucalyptus, Acacia, Evergreen Oak, or even Plane. Hyères might be named the town of Palms, so numerous are its date trees. In Bordighera this palm is extensively cultivated for the sake of its leaves, which are sold to Roman Catholics and Jews for the decoration of churches at Easter, and for the feast of Tabernacles. The whole of the head of leaves is tied up tightly in the autumn so that the inner leaves may bleach. At the time of my visit there was scarcely a date tree in the town that was not tied up in this way.

Almost as striking and as plentiful as the Date are *Phœnix canariensis* and *Washingtonia filifera* (Pritchardia filamentosa). The former is said to have been first introduced into the gardens of Baron Vigier at Nice about 20 years ago, where the two parents of all the plants of this palm now on the Riviera are still in existence. It is a palm of very rapid growth, of gigantic proportions and much more ornamental than the date palm, or indeed than any of the species of Phœnix grown there.

Equalling the Canarian Phœnix in its extensive use, in its proportions and in rapidity of growth, is the *Washingtonia*. The growth made by this palm on the Riviera is astonishing, and it appears to thrive equally well in all the stations. There must be hundreds of thousands of plants of it in the gardens and nurseries visited, and the prices asked show that there is a great demand for it.

After these, the palm which ranks next in popularity is *Chamærops humilis*, which is abundant in most of the gardens and occurs sometimes as a street tree. It fruits when only a few feet high, producing annually very large bunches of bright orange fruits about the size of sloes. When writing in 1880 of the most important among the introduced plants on the Riviera, Professor Allman stated that, "It is remark-" "able, and not easily explained among the phenomena of distribution, "that while the southern Date Palm grows here so freely, and even "ascends to some height upon the hills above the coast-line, the

" *Chamærops humilis* (the truly indigenous palm of the European " shores of the Mediterranean, and still abundant in the south of Spain " and in Sicily) is nowhere to be met with." Certainly I saw thousands of it, some of them old and almost worn out. They were, however, all cultivated plants, and although there were numerous seedlings near the specimens in fruit, I have no recollection of having met with a truly wild example of this palm. As most of my time, however, was devoted to gardens and not to the wild flora, my failing to see any wild plants of this palm does not count for much.

The palms hitherto named, as well as some others seen, were easy to recognise, their characters being familiar. But there are a great many plants in the gardens of the Riviera with names which certainly do not belong to them. In some cases the errors were apparent enough, as for instance when we saw *Livistona inermis* named *Copernicia cerifera*, a Ficus of some kind called *Artocarpus incisa* and *Strelitzia augusta* labelled *S. Reginæ*. But the difficulties which give one most trouble are the different and various names which are given to what appear to be absolutely the same plants. Some explanation for this deplorable state of things is found in the fact that the gardens of the Riviera have been stocked chiefly by nurserymen, many of whom are careless in respect of names. The experience of Dr. Glaziou, Director of the Botanic Gardens of Rio de Janeiro, who has recently been staying at Kew, may be mentioned here as bearing upon this difficulty of nomenclature, and particularly in its relation to Palms. For many years Dr. Glaziou has been purchasing and planting in his garden at Rio as many palms as he could obtain from nurserymen and others. Already a large number of the plants thus procured have grown to maturity, flowered, and have been determined. Many of them, he says, proved to be wrongly named, whilst the number of those which proved to be identical, was surprising. It is desirable that useful work of this kind should be gone on with. At Kew we are conscious that the names of some of the plants, and particularly of some of the palms, are probably not correct; but they have been obtained under these names and are generally grown as such. Until they flower, however, it is impossible to deal with them satisfactorily.

One of the most interesting of the gardens visited was a branch establishment at Hyères, of the Société d'Acclimatation, in Paris. Here a good deal of what may be called experimental gardening is practised, plants of all kinds being planted and tested as to their hardiness, &c. Some of the most important of them are included in the lists which follow. The cultivation and keep generally in these gardens were first rate, and most of the plants were legibly labelled. When inspecting these gardens the idea was suggested that a well-managed botanical station, devoted chiefly to experimental testing, proving, and breeding operations amongst plants, would, if established in some such favoured locality as Hyères, be capable of much valuable work.

Mr. Hanbury and Dr. Bennett at Mentone and Professor Naudin at Antibes have done much by cultivating and distributing useful plants of all kinds from their richly stocked gardens. But there is still much to be done by the systematic botanist before the names of the plants are in harmony with the names in use at Kew.

PALMS.

The number of genera represented in the list of those noted amounted to 16. I was surprised not to find any plants of such genera as *Caryota*, *Astrocaryum*, *Geonoma*, *Oreodoxa*, and *Wallichia*. There does not appear to be any good reason why such plants should not thrive equally well with those already there. Probably, however, these and many other palms are unrepresented because no one has tried them.

Brahea.—The true Braheas are represented by only four species, all of them natives of Mexico. They are very similar to Thrinaxes in general appearance, and are related to them. The stems are smooth, about 30 feet high when mature, and the head is composed of short stalked palmate leaves, with a few short spines along the margins of the base of the petioles:—*B. lucida* (egregia), a fine plant in perfect health. *B. nitida*, with a stem 9 feet high, a noble head of leaves and drooping panicles, 8 feet long, of fruit and flowers; the inflorescence developes one year, the flowers open the next, and the seeds ripen the year following. Both these were in the gardens at Villa Valetta, Nice. *B. nobilis*, a fine specimen in the middle of a lawn at Monte Carlo. The blade of the leaf is 4 feet in diameter, and it is silvery on the under side. A plant at Nice, called *B. calcarea*, is evidently a species of *Erythea*, as also is the palm commonly known as *B. Roezlii*.

Bacularia.—A small genus of dwarf pinnate-leaved palms from Australia. *B. monostachya*, the walking-stick palm, was seen in the gardens of the Acclimation Society at Hyères. It was placed under a large handlight, and looked unhappy. This plant is grown in a cool greenhouse in England.

Chamœdorea.—Only one species, viz., *C. scandens*, was noted. It was at Nice, and apparently quite happy, trained up the stem of a Cocos on a lawn. *C. elatior* is large and healthy in a cold house at the Jardin des Plantes, Paris.

Chamœrops humilis.—A common garden plant all along the Riviera. It fruits very freely, and some of the varieties are exceedingly ornamental when bearing their enormous collar-like whorl of rich orange fruits. In no palm have I noticed so much variety as in this *Chamœrops* In some the petiole is short and stout, in others long and attenuated; some petioles were armed with stout spines, half an inch long, others had short spines, and others were merely serrated. The leaf blade showed an equal amount of variation, some plants having stiff board-like leaves, others thin and drooping ones. They varied in hue from grey to deep green. In the fruit also there was variation in size, shape, and colour. It would be easy to select half a dozen plants with characters distinct enough to rank as good species. Something of the kind has been attempted, such names as *C. Biroo*, *C. Ghiesbreghtii*, and *C. tomentosa* being given to plants which are merely varieties of *C. humilis*, *C. Fortunei* (see *Trachycarpus*).

Chrysalidocarpus lutescens, generally known as *Areca lutescens*, has been tried out of doors at Nice, but it cannot be established owing to its not being able to bear the low winter temperature.

Cocos.—This genus is well represented; *C. flexuosa* being very abundant. In the garden of Villa Valetta there is a magnificent grove of it rising straight from the lawn to a height of 30 feet or more. In another place it and *Musa Ensete* were massed together. Fruiting trees were seen at Hyères, Nice, and Cannes. I was informed that this species is at least as hardy as the Date. The effect of its enormous plume-like leaves towering up above most of the other plants in the gardens may easily be imagined. The stem of one specimen measured at Cannes was 15 inches in diameter. Under the names *C. campestris*, *C. Yatai*, *C. Bonneti*, and *C. australis* are plants which apparently are closely related to each other, probably merely varieties of one species. According to Wendland and others there are distinct species to which these names belong, but so far as I could make out it is questionable if they exist in the gardens of the Riviera. We have these badly named plants at Kew, no doubt from the same source as those on the Riviera. The manager of the gardens of the Floricultural Society informed me that, in his opinion, *Cocos campestris*, *australis*, and *Bonneti* are certainly the same or seminal forms of one species; just as the plants distinguished in gardens under the names of *Kentia Fosteriana*, *K. Belmoreana*, and *K. australis* are obtained from seeds of the same tree.

Whatever their names, however, the Cocoses named as above in the gardens of the Riviera are very ornamental, their elegant arching pinnate leaves being almost silver white; they thrive, too, as well as any of the palms grown there. *C. Blumenavii*, apparently the right thing, is also represented by fine examples in several of the gardens visited. In a cold greenhouse at Paris *C. insignis* (*Glaziova*) is apparently quite happy. An example of it is also in the Temperate House at Kew.

Erythea.—This genus comprises two species of Californian palms, with fan-shaped rigid glaucous leaves. They have not been long in cultivation, but already one of them, commonly known as *Brahea Roezlii*, is plentifully represented on the Riviera. It is sometimes called the Silver Palm, healthy plants being almost white. At Hyères, Cannes, Nice, and Monte Carlo, are some very fine examples of it, all planted as single specimens on lawns. The largest seen was 8 feet high and 8 feet through, the stiff leaves forming a grand mass from the ground to the top. Another plant met with under the name of *Brahea calcarea* is either a form of *E. armata* (the correct name for *Brahea Roezlii*), or is the second species, viz., *E. edulis*.

Howea.—The two plants commonly known as *Kentia Fosteriana* and *K. Belmoreana* are now placed in the genus *Howea*. They are merely forms of one species, as is pointed out under t. 7018 of the Botanical Magazine. Small plants of these and of *K. Lindeni* and *K. Canterburyana* were noted under handlights in the garden at Hyères; also a large specimen of *H. Belmoreana* at Cannes, and quantities of young plants out of doors at Nice. So far, however, all efforts to establish them have failed, as they cannot endure the winter temperature. Our experience at Kew in the cultivation of all the Howeas is that they must have a tropical temperature at all times.

Jubæa spectabilis, the Coquito Palm of Chili.—Several fine examples were seen, notably one in the garden of the Villa Thuret, at Antibes. A magnificent specimen of this palm is a conspicuous object in the Kew Temperate House.

Livistona.—The common garden species of this popular genus are plentifully represented in the gardens visited. *L. australis* (*Corypha*) occurs in many places, and some of the specimens are very large trees, with stems as thick as that of the *Washingtonia*. A grove of many large plants of *L. sinensis* (*Latania borbonica*) formed a magnificent feature in the gardens of Villa Valetta. *L. mauritiana*, which is probably merely a variety of *L. sinensis*, is also represented by large plants at Cannes. The most interesting plant of this genus, however, is a very fine example of the rare *L. inermis*, of R. Brown, in the gardens of Villa Valetta. It has a bare stem 6 feet high by 1½ feet in diameter at the base. The head is made up of a large number of shining green leaves, the petiole of which is 6 feet long and margined with spines at the base. The blade is divided almost to the base, and it has a distinct midrib which is curved so as to produce a very extraordinary effect. The form of the leaf may be called a combination of the pinnate and palmate characters. A plant of this rare palm is in the Kew collection; there is also a fine example of it in the collection at Blenheim. A large specimen was also noted in Baron Vigier's garden at Nice. Mr. Bull distributed plants of it some years ago under the name of *Corypha decora.*

Phœnix.—Of all palms the cultivated species of *Phœnix* are the most difficult to define. There is abundant evidence to show that a considerable number are of hybrid origin, or mongrels, bred by accident in gardens. In some of the gardens of the Riviera, for instance, there are numerous kinds of *Phœnix* all growing together, and many of them flower and fruit annually. Being diœcious, seeds are not produced unless the pollen is blown or carried by bees, &c. from the male to the female plant. Under these circumstances it appears to me next to impossible for the progeny of these cultivated palms to be pure. Besides this fact there is also that of the cross-breeding among Phœnixes practised by the gardeners of the Riviera. Count Kerchove, in his book "Les Palmiers" (1878), gives as an example of the wonderful fecundity of a *Phœnix* the case of a *P. reclinata* which at Nice had been fertilised with pollen from *P. tenuis*, *reclinata*, and *pumila*, and produced 20,000 seeds! Several plants bearing seeds which were the result of crossing one kind with another were pointed out to us at Cannes and elsewhere. Mr. Scott, Curator of the Royal Botanic Garden, Calcutta, hybridised, previous to 1879, several species of *Phœnix*. The names of these plants, therefore, are not to be relied upon. I give a list of those noted:—

P. canariensis; no doubt of hybrid origin.
P. cycadifolius; very like *P. sylvestris.*
P. dactylifera; the ordinary date.
P. humilis; certainly not *P. humilis* of Royle; probably *P. reclinata*, or a hybrid.
P. leonensis; no doubt *P. spinosa* of the Cape.
P. paludosa; certainly not that species, but not unlike *P. reclinata.*
P. reclinata; not always true.
P. senegalensis; identical with what we know as *P. reclinata.*
P. spinosa.
P. sylvestris.
P. Vigieri; a synonym of *P. canariensis.*

These were the named plants. In addition, there are many without names and which were mostly very mongrel-like in appearance. *P. canariensis* is the most useful of all. The largest specimens seen were a pair, male and female, in the garden of Baron Vigier, at Nice. They each have a clear stem 12 feet high and 4 feet in diameter. The leaves are very large, probably 20 feet long, gracefully arched, and bright green; they form a head 30 feet through. These two plants are said to be the progenitors of all the plants of *P. canariensis* in the Riviera. I was informed by the gardener that they were 20 years old, and that they had originally come from the nursery of Messrs. Verschaffelt, of Ghent. The rate of growth of this species is surprising. Here are the dimensions of a plant said to be not more than 10 years old:—Stem, 4 feet high, 3 feet in diameter at base; number of leaves, about a hundred, forming a magnificent head 25 feet across. Another specimen, about the same size, bore eight huge bunches of fruit, each bunch about half a hundredweight; the fruits, which contained fertile seeds, were about as large as sparrow's eggs; the seed is larger than that of any Phœnix known to me. It is said that this Phœnix bears cold better than *P. dactylifera.* The raising of these Palms from seeds is done on a large scale, and thousands of small plants, 2 or 3 feet high, are sent annually to Paris and other towns for use in the decoration of saloons. The seeds are sown in beds in the open; the seedlings are pricked off in shallow trenches in the same way as celery is planted here. This is done as a precaution against drought, as the trenches can be regularly flooded in summer.

P. rupicola had been tried at Cannes, but it perished in the winter temperature.

Rhopalostylis.—Both species are represented in several of the gardens visited. They are commonly known under the names of *Kentia* (or *Areca*) *sapida* and *Baueri.* The former was uninjured by 6 degrees of frost.

Sabal.—Some very fine specimens of several species of *Sabal* were noted. At Hyères, Cannes, Antibes, and Nice, *S. Blackburniana* (of which there is a noble specimen in the Palm House at Kew), is represented by large examples in perfect health. *S. Adansoni*, *S. havanensis*, *S. Palmetto*, *S. umbraculifera*, and one called *S. Ghiesbreghtii*, were also noted. No doubt all the species of this noble genus could be established in the Riviera.

Seaforthia elegans.—A small plant under a handlight, at Hyères, and a beautiful specimen, 20 feet high, in perfect health, on one of the lawns at Villa Valetta. Considering the ornamental character of this palm, its popularity and its hardiness, it is surprising that only these two examples of it were noted.

Trachycarpus (*Chamærops*) *Fortunei.*—A grove of large plants at Cannes, and a very fine specimen, 20 feet high, at Nice; this palm is quite hardy at Kew.

Trithrinax.—Under the name of *Thrinax Chuco*, several fine plants were met with. The manager of the Floricultural Society, at Nice, where a number of plants are grown, stated that the cold of 1887 (11 degrees) did not hurt this palm.

Washingtonia.—One of the glories of the Riviera. It is a native of California, where it is known as the Desert Palm. It was first brought to notice by Dr. C. C. Parry, who discovered it in 1849–50, but it does not appear to have been named until 1860, when it was called, *Brahea dulcis*?, Wendland afterwards placed it in *Pritchardia*, and finally founded the genus *Washingtonia* upon it. Apparently, it was not introduced into European gardens until 1875, and is, therefore, a comparatively new palm. Notwithstanding this, there are some very large specimens of it on the Riviera, where it is known by the name of *Brahea filifera*, or *Pritchardia filamentosa.* I could not see any characters in the plants pointed out as *W. robusta* to distinguish them from *W. filifera*; the reddish hue of the base of the petiole appears to be the principal difference.

At Villa Valetta, on a sloping lawn in front of the house, is a grove of about 60 magnificent specimens of this palm, to me a marvellous sight. Most of these plants had huge onion-shaped stems, 10 feet in circumference at the base, and about 10 feet high, some even higher. The crown of foliage was 20 feet through, and was composed of from 50 to 80 leaves, each with a stout armed petiole, 5 feet long, a blade 4½ feet across, and ornamented with numerous white drooping filaments, a foot in length. The general aspect of the largest was very similar to that of *Sabal Blackburniana*, in the Palm House at Kew. I was assured that the largest of these plants was not more than 12 years old, and from the date of the introduction of the species this cannot be far from correct. The rate of growth in this palm must, therefore, be astonishing. At Nice I saw a specimen the stem of which was 15 feet high. In exposed situations and within a few yards of the sea, this palm is perfectly healthy.

CYCADS.

The fewness of the Cycads met with was disappointing. I believe that everyone of the African and most of the Australia species would thrive on the Riviera. Mons. Dognin, whose garden is the richest in beautiful and rare plants, and the most perfectly planned I have ever seen, arranged a group of Cycads against a large bank of stones, planting with them large Bromeliads, Aloes, Opuntias, Agaves, &c., and backed with large Magnolias, *Persea*, *Cocos* and tall massive Bamboos. All the Cycads are in good health, their names being as follow :—

C. siamensis ; a large stemmed specimen with a fine head of leaves.
C. revoluta ; healthy in shade.
Dioon edule.
Encephalartos Altensteinii.
　　„　　*horridus.*
　　„　　*Lehmanni.*
　　„　　*villosus.*
Macrozamia spiralis.
　　„　　*Macleayi.*

In the same town, Cannes, there are also good healthy plants of *E. Caffer* (E. longifolius) and in Mr. Hanbury's garden at Mentone there is a fine example of *E. horridus*, var., which bore three fine cones at the time of my visit. *Dioon edule*, on the lawns at Monte Carlo, was in fine health, but *Cycas revoluta* was unhappy.

BAMBOOS.

After the Palms, the most tropical feature in the gardening of the Riviera is the Bamboos, which are largely used in the composition of the best gardens, both public and private. To a northern gardener the elegance and grandeur of some of these Bamboos constitute some of the chief charms of the Riviera. Some of the specimens are of very large dimensions, as for instance one of *B. vulgaris*, in Baron Vigier's garden at Nice, which measures 40 feet through in every direction and is 35 feet high. It contains hundreds of stems or canes, each 3 inches in diameter, and straight and smooth as a gun barrel. It is planted on one side of the lawn near the house. As fences, screens, and boundary lines the Bamboos are frequently used, and nothing could be better, as they are quick growers and evergreen. All the kinds noted were in splendid health, and from the manner in which they had taken possession of the ground, it was evident that their requirements are abundantly satisfied. The finest and healthiest examples are in wet ground, often on the edge of water. Most of them are heavily manured annually.

In England we have not hitherto made the most of this beautiful family of plants, many of which may be grown out of doors successfully in all the milder parts of the country, whilst in large conservatories, where they would get protection from cold in winter, a still greater number would be found to thrive. That they are much superior to many of the plants at present used for such positions must be evident to anyone acquainted with the extraordinary elegance and grace of a well-grown Bamboo.

The Kew collection comprises over 50 named sorts, a few of which are tropical, whilst the bulk of them are either quite hardy or require only the temperate conditions supplied by the winter garden.

The names of Bamboos are as confusing as are those of garden palms. In one as in the other it is only very rarely that the plants flower under cultivation, so that many of the names, which are given by nurserymen, can only be problematical. For garden purposes this would not be of much consequence, the difficulty arising only when growers do not agree as to what names the plants shall bear.

Now that so many kinds of Bamboo are in cultivation under favoured conditions on the Riviera, it would be worth while to watch them, and as they flower, get them properly determined.

It is generally supposed that nearly every member of the Bamboo order perishes immediately after flowering. There are many recorded instances of this having occurred. But with regard to a considerable number of the species the exact flowering age has not been ascertained. Some are said to grow 40 years before flowering. Another remarkable fact is that all the plants of one generation flower at the same time, no matter how different may be the conditions in which they happen to be placed. I was told that all the plants of *Thamnocalamus Falconeri* (Bambusa gracilis) of the Riviera flowered and died last year. Numerous seedlings have since sprung up about the old stools, but the latter certainly all perished. This proved to be the case with a plant of *Arundinaria falcata*, which flowered at Kew in 1886.

The following are the kinds noted. The names in brackets are what I consider to be the correct names, according to Munro, &c.

B. aurea, Sieb.—A Japanese species, now well known in gardens. It was in cultivation at Kew in 1866, and is here still. It is one of the most elegant of the hardy Bamboos. In the gardens of the Acclimatisation Society at Hyères there is a magnificent specimen with stems 25 feet high, and not more than 1½ inch in diameter. The nodes are prominent, and less than 4 inches apart on the lower part of the stem. When ripe the stems are of a rich greenish-yellow colour. The leaves are small, with a distinct petiole.

B. gigantea (Dendrocalamus giganteus, *Munro*).—The largest of all the Bamboos. The specimen in the Palm House at Kew produces stems 40 feet long and 12 inches in circumference, but wild plants have stems as much as 26 inches round. In the garden at Villa Valetta, Cannes, there is a very fine mass with stems 30 feet high and 4 inches in diameter. It is a native of India.

B. gracilis (Thamnocalamus Falconeri, *Hook. f.*).—A slender and somewhat fragile stemmed plant from the Himalayas. It is not uncommon in gardens as it makes an elegant pot plant. It was plentiful on the Riviera till last year, when all the plants flowered. There is a plant at Hyères called *B. gracilis rustica*, in which the leaves are narrow, with incurved margins.

B Mazelii, Hort.—A fine mass at Hyères and Cannes. The stems are 25 feet high, bright yellow when mature, the nodes prominent and close together at the base, the branches loose, and the leaves short and twisted on the petiole. It looked suspiciously like *B. aurea*.

B. Metake (Arundinaria japonica, *Sieb. & Zucc.*).—Much used on the Riviera, where it is as ornamental as it usually is in England. It is always strongest when grown near water, although it grows well in an ordinary border. At Kew there is a specimen 12 feet high. According to Munro it is known as *B. mitis* in the gardens of Paris.

B. mitis, Poir.—A magnificent specimen on the lawn at Villa Valetta, the stems 30 feet high and 3 inches in diameter at the base, becoming shining yellow with age. The nodes are prominent and about 9 inches apart, the leaves short and not dense. There is a small plant of it at Kew, obtained last year from Lavallée's collection. It is said to be from Cochin China.

B. nigra (Phyllostachys nigra, *Munro*).—A clump of this, 20 yards through and rising to a height of 30 feet, in the garden of Baron Vigier at Nice, was one of the most striking objects seen on the Riviera ; thousands of naked shining blackish purple stems rising from the lawns and losing themselves in the mass of green foliage above. This species is quite hardy in England, but it does not grow to its full height except when in a very sheltered situation or under glass, as at Chatsworth, where in the large conservatory it is exceedingly handsome.

B. quadrangularis, Fenzi.—A very interesting species from China, with stems 15 feet high by 1 inch in diameter, and distinctly quadrangular ; the nodes are armed with decurved teeth-like spines. These dimensions are of a clump 6 feet through on one of the lawns at Villa Valetta. There are plants at Kew, both outside and in the Temperate House. It is a handsome and distinct Bamboo. For an account of it, see an article in *Nature*, vol. xxxii. (1885), p. 391.

B. Quilloi.—I cannot find any information with regard to this plant. Carrière described a Bamboo in the *Revué Horticole*, under the name of *B. Duguilioi*, but Munro appears to have referred this to *Phyllostachys puberula*, included by him under *P. nigra*. The plant known under the above name is represented at Hyères by a large clump with stems 25 feet high, 1½ inch in diameter, bright yellow, with a faint tendency to become quadrangular. We have a plant of it at Kew. It is a most elegant Bamboo.

B. scriptoria, Hort. (B. nana, *Roxb.*).—I believe that *B. scriptoria* of the Riviera gardens is merely a form of the well-known Chinese *B. nana*. It has the same dense habit, thin green canes, and small leaves with the underside glaucous, which characterise *B. nana*. In some of the specimens seen the stems were 9 feet high. A variegated form called *B. scriptionis* is the same as is grown at Kew as *B. nana variegata*.

B. Simoni, Carr.—A beautiful Bamboo, and perfectly hardy in England, as is shown by the fine example in the Cambridge Botanic Garden, and by the plants at Kew. It is also very handsome at Hyères, where the canes are 15 feet high, quite smooth and cylindrical, less than an inch in diameter, and coloured deep olive green. This plant is worth the attention of English horticulturists on account of its elegance and hardiness, and its evergreen character.

B. sulphurea.—Apparently a garden name for a very handsome Bamboo, with stems 18 feet high, 1½ inch in diameter, the nodes 9 inches apart, and the internodes deeply furrowed on one side. When mature the stems are a rich orange yellow colour. There is a fine mass of it at Villa Valetta. It is also in the Kew collection.

B. verticillata.—This is probably the "Male Bamboo" (Dendrocalamus strictus, *Nees*), a common Indian species, the stems of which, according to Munro, are universally used as lance-staves. The specimens seen were large clumps, the stems 20 feet high, 1 inch in diameter, the nodes at the base a foot apart, the upper ones bearing each a crowded cluster of short leafy branches. When old, the stem is bright yellow. It is a well marked handsome Bamboo.

B. violescens, Carr. — A beautiful Chinese Bamboo, which was introduced into the Jardin d'Acclimatation in 1870, in the branch of which at Hyères a fine clump was noted. The stems are 10 feet high, ¾ inch in diameter, much branched towards the top, the internodes somewhat flattened on one side, and striped with violet on a greenish yellow ground. The leaves are glaucous on the under side. Young plants of it are in the Kew collection.

B. viridi-glaucescens, Hort.—One of the handsomest of cultivated Bamboos. It is quite hardy in England, and in France it is one of the commonest. It grows very rapidly, has handsome foliage, transplants easily, and is a first-rate pot plant. It is frequently used in France for the embellishment of entrance halls, and is very effective. The stems of the Riviera plants were over 20 feet high, very slender, the nodes about a foot apart, dark green when young, bright yellow when mature.

B. vulgaris, Wendl. (B. Thouarsii). — Some astonishingly large healthy specimens of this well-known species were met with. Apparently it does not require tropical treatment such as it usually gets. At Hyères, Cannes, and Nice, it is especially fine; in the last-named place measuring 40 feet through, and the canes 35 feet high. The plant in the Palm House at Kew must be 30 years old; it has not yet flowered.

Agaves and other Succulent Plants.

The excessive heat and drought of the summer, alternating with the moisture and mildness of the winter on the Riviera, afford exactly those conditions which are especially favourable to the majority of succulent plants. South Africa, Mexico, and the most southern of the States of North America are the homes of the greater portion of these plants, and the nature of the seasons there is very similar to what we meet with on the Riviera. Consequently we find such plants as *Agave*, *Aloe*, *Furcræa*, *Yucca*, *Beschorneria*, *Dasylirion*, *Opuntia*, and other kinds of Cacti, abundantly represented there, and thriving, at least, as well as they do in their native haunts. The cultivation of such plants must, therefore, be attended with infinitely less trouble and expense than that of Palms, for instance, so many of which require to be frequently and heavily watered during the hot dry summer months. Agaves and Opuntias appear to have run wild in some parts, whilst those in gardens, where they receive a little care, attain often marvellous proportions, and are really magnificent objects. Opuntias are employed in the composition of the beautiful garden at Villa Valetta with the most admirable results. *O. maxima*, a huge specimen, 18 feet through and 12 feet high, its joints 20 inches long by 14 inches wide, coloured milk white with pure white spines, and bearing numerous large purple fruits. This was on a lawn of rich green, and had as a kind of frame work the deep green plumes of *Cocos plumosa* and elegant bamboos. *O. armata argentea*, here and also in Mr. Hanbury's garden at Mentone, is a cylindrical stemmed species, and forms a mass 6 feet through and a foot high, the stems so thickly covered with spines as to be completely hidden. And these spines, which are fully 2 inches long, are each enclosed in a sheath of the purest white. Lying on the top of a mass of stones, the effect produced by this plant is delightful. Those who have learnt to despise

Cacti as ornamental plants should see them as they appear on the Riviera.

Agaves are equally grand. To see them fully developed, their huge leaves spreading in all directions and forming a gigantic rosette as large as a house, whilst from the centre rises a mast-like flower-spike, 30 feet high, and crowded with flowers, gives a very different impression from anything which can be effected with pot culture.

Dasylirions are grown very largely both for indoor decoration—the smaller plants being lifted and sent to Paris, &c.—and for effect in the outdoor garden.

AGAVES.

Commencing with the Agaves, the following were the most noteworthy of those seen in the various gardens inspected :—

A. americana.—Frequent as large groups in gardens; naturalised in many places.

A Franzosinii, Hort. Hanbury.—A very fine plant, as large as *A. Salmiana*, with glaucous leaves. It is probably new.

A. glaucescens, Hook.—Very healthy at Cannes. When well grown this is a handsome Agave. Its leaves are very soft and succulent, and are easily damaged.

A. Ixtli, Karw. (*A. rigida*, Mill).—Large specimens at Cannes and Mentone, the leaves about 5 feet long ; they are, therefore, the variety called *A. elongata*, Jacobi.

A. Jacobiana, Salmdyck.—A handsome broad-leaved plant, in Mr. Hanbury's collection.

A. potatorum, Zucc.—Some grand plants at Cannes, almost double the size given in Mr. Baker's description.

A. Rumphii, Hassk.—Mr. Baker refers this to *A. vivipara*, but the plant under the former name in Mr. Hanbury's garden looks like a gigantic *A. rigida*. It is a very fine Agave, the leaves about 5 feet long and very numerous.

A. Salmiana, Otto.—In the gardens at Villa Thuret there is a magnificent specimen of this fully 10 feet high and wide. At Mentone it was in flower, the spike 30 feet high and a foot in diameter at the base. A variety called *latifolia*, also at Mentone, had a flower-spike several feet higher and thicker. The pair formed a magnificent spectacle in Mr. Hanbury's garden. I was told by the gardener at Villa Valetta that this species and *A. potatorum* when about to flower develops first short lateral flower-spikes and in the year following a terminal and final spike. A plant of *A. Salmiana*, var. *variegata*, bore several of these lateral, almost basal, spikes at the time of my visit.

A. Scolymus, Karw.—Flowering at Mentone, the spike 25 feet high.

A. spectabilis, Tod.—Two plants met with under the name of *A. applanata* probably belong to this species. There were large specimens with leaves 5 feet long, very glaucous, with a large dark brown terminal spine. The species flowered for the first time at Palermo in 1879 and was named by Sigr. Todaro. The leaves of *A. applanata* seldom exceed a foot in length.

A. vivipara, Linn. (A. Cantula).—A distinct species more resembling a Furcræa. It has lately flowered at Mentone.

BESCHORNERIA.

Several species of this genus of *Amaryllideæ* are of frequent occurrence on the Riviera gardens. They are dwarf stemless plants with a tuberous rootstock and tufted habit. On the lawn at Monte Carlo, and in the garden of the Acclimatisation Society at Hyères, some of the specimens measured 8 feet through. When in flower, these must make a beautiful display. The general effect is not unlike that of large clumps of *Yucca recurva* or *filamentosa* here.

Mr. Gumbleton states that at least one species of *Beschorneria* is hardy at Scarborough and at Cork.

The kinds seen on the Riviera were :—

B. argyrophylla, Hort. Possibly *B. Decosteriana*, of Baker.

B. glauca, Hort. Very similar to the last named.

B. superba, Hort., Hanbury. Also cultivated at Kew, but not yet flowered.

B. yuccoides, Hook. A plant was so named at the Villa Thuret, but the leaves were distinctly filamentose, a character which is absent in the Kew plants.

FURCRÆA.

The following were noted in one or other of the various gardens visited. At Mentone, Mr. Hanbury has a good collection of Furcræas, mostly very large healthy specimens.

F. Bedinghausii, K. Koch, (Roezlia regia); large plants, with heads 8 feet through on stems 4 feet high. It flowered recently at Villa Valetta. This plant is also cultivated as *F. longæva*, which is, however, a very different plant. It is also represented in Mr. Hanbury's collection under the erratic name of *Yucca Parmentieri*.

F. cubensis, Haw., and its variety *inermis*.

F. flavo-viridis, Hook.

F. gigantea, Vent. The species which yields Mauritius hemp.

F. Lindeni, Jacobi. A magnificent plant with leaves 8 feet long, coloured rich yellow and green. On a lawn at Monte Carlo.

F. longæva, Karw. Several fine specimens in gardens at Cannes.

BEAUCARNEA AND DASYLIRION.

Two species only of *Beaucarnea* were noted, viz., *B. longifolia*, Baker, of which some very fine specimens were seen, the most striking perhaps being at Villa Valetta. Its stem is 8 feet high, 2 feet in diameter at the base, and it bore no less than 12 distinct heads of foliage, no doubt the result of its having flowered. What I took to be the same species was a plant in flower at Hyères. It had no visible stem, but a large rosette of recurved strap-shaped leaves about 4 feet long, in the centre of which stood a massive pyramid of flowers fully 6 feet high and 2 feet through at the base; it was a female. *B. recurvata*, Lem., was noted in several gardens and was in flower at Mentone. It is an elegant plant, much less coarse than *B. longifolia.* It is known generally in the Riviera as *Pincenectitia tuberculata.*

Dasylirion is a popular garden genus. Thousands of plants, young and old, were noted in the various nurseries visited, whilst in private gardens some very fine specimens were seen. *D. acrotrichum*, Zucc., is the commonest. At Hyères it was labelled *Bonapartea gracilis.*

D. glaucophyllum, Hook., was in flower at Hyères; the plants exactly like that now bearing a spike in the Kew collection. It is known in the Riviera as *D. glaucum* and *Bonapartea glauca*. *D. graminifolium*, Zucc., is an elegant little species with scarcely any stem and very narrow spiny leaves. A distinct looking species, unnamed, with narrow, rigid, entire leaves and flower-spikes 5 feet high, was represented by numerous plants at Hyères.

D. quadrangulatum, S. Wats.—This is the plant often known as *Xanthorrhœa hastilis*. It is also, I believe, the *Agave striata*, var. *recurva*, of Baker. In the garden of the Acclimatisation Society at Hyères there is a fine example which was in flower at the time of my visit; it was named *Xanthorrhœa hastilis*. The foliage and habit were exactly the same as those of the plant in the Kew collection called *Agave striata*, var. *recurva*; a provisional name, the plant never having flowered. The specimen at Hyères bore a spike 18 feet high, the upper half clothed with adpressed branches of brown, trigonous, seed-like flowers, not unlike those of a female *D. glaucophyllum*. There is a plant of this so-called *Xanthorrhœa hastilis* at Kew, which came from the Jardin d'Acclimatation, Paris. *Xanthorrhœa* proper is Australian, and has an inflorescence somewhat like a bullrush. In the garden at Monte Carlo there is a fine example 7 feet through of *D. quadrangulatum*; it is labelled *D. juncæfolium*. Mr. Hanbury has a good plant of true *Xanthorrhœa australis*.

YUCCA.

A magnificent group of large plants of *Y. aloifolia* in the garden at Villa Valetta is one of the most striking and novel of the many effects obtained in this garden. The height of the plants averages 15 feet, and many of them are branched. The bases of the dead leaves have been left on the stems, and they have curled and become a rich light brown colour. The gaunt stems, their heads of dark green spear-leaves, and the strange effect produced by the old leaf bases presented a picture peculiarly picturesque. A large group of tall plants of the variegated form at Hyères was almost as effective. All the Yuccas appear to be exceptionally happy under the conditions supplied on the Riviera.

The most striking kinds are as follows:—

Y. aloifolia, Linn. and its variegated form.

Y. constricta, Buckley.—A plant in Mr. Hanbury's collection under the name of *Y. elata marginata* is probably this species. It is near *Y. angustifolia* in habit, but the leaves are shorter. It is a pretty little plant. The garden name may be accounted for by the fact that Engelmann named this species *Y. angustifolia*, var. *elata*.

Y. Desmetiana, Baker.—A plant 9 feet high at Villa Valetta. It is one of the prettiest of the small leaved Yuccas, and is a useful decorative plant.

Y. filifera, Makoy.—A magnificent specimen at Villa Valetta, with a stem 3 feet in diameter at the base; another at Antibes is almost as large. This species is said to attain a height of 50 feet, and its trunk a diameter of 5 feet. The plant at Antibes flowers every year. There is a good figure of this magnificent Yucca in the *Gardener's Chronicle*, June 1888, p. 743, figs. 97, 100.

Y. guatemalensis, Baker.—A variable species, and apparently some of its forms have received garden names. I consider the following to belong to this species, viz., *Y. Draconis* (Hort. Hanbury, not of Linn.), *Y. Ghiesbreghtii* (Hort. Hanbury), *Y. Eleana* (Hort. Dognin).

Y. Mazelii (Hort. Dognin).—The last named is 25 feet high, and the stem 2 feet through at the base.

Y. Whipplei, Torrey.—A beautiful plant in Mr. Hanbury's garden, fully 3 feet through, with hundreds of straight narrow leaves. It has the aspect of an *Agave* rather than of a *Yucca*. So far as I know this plant has not been a success in English gardens.]

MISCELLANEOUS PLANTS.

In the foregoing notes only those plants are mentioned which from their rarity and supposed delicate nature might not have been expected to thrive satisfactorily even in so favoured a clime as the Riviera. In addition there are also a great many plants which cannot be grouped, and which may go into a bare list of names. It does not appear to be necessary to go further than this, nor does the space at my disposal permit it. The main object is to call attention to the vast number of interesting plants which are in cultivation on the Riviera, so as to afford some idea of what conditions such plants may be expected to thrive in elsewhere.

For a list of plants of all kinds which are cultivated in Mentone the catalogue of plants grown in the open air in the garden of Mr. Hanbury at La Mortola should be consulted. This catalogue is a most interesting one. It bears testimony to the enormous trouble and perseverance that have been brought to bear on the highly useful work of experimental and scientific horticulture. Of course the catalogue contains the names of all the plants in existence at La Mortola at the time of its compilation. It does not attempt to show how many of the plants have become established and are adapted to the neighbourhood, and how many merely exist or have to be frequently renewed. In the latter portion of this catalogue the plants are arranged in geographical order, thus showing how much of the flora of the various divisions of the world is represented in the garden at Mentone.

LIST OF SOME OF THE MOST INTERESTING PLANTS CULTIVATED AND ESTABLISHED ON THE RIVIERA.

Acacia, many species, some represented by large trees. *A. Farnesiana* is largely grown for its flowers, used in scent making.

Aloe; many species; the most noteworthy as being exceptionally large and healthy, are: *A. ciliaris*, very popular on account of its being always in flower; *A. Dyckii*, *A. frutescens*, *A. nobilis*, *A. plicatilis*, and *A. africana*. At Villa Valetta there is a colony of Aloes, planted so as to produce the most natural wild effect.

Aloysia citriodora, cultivated and used in scent making.

Aralia; A. papyrifera grows to a large size, and is very ornamental. *A. dactylifolia*, *A. Humboldtiana*, and others, as garden plants.

Azalea indica, not represented by large specimens.

Banksia; several species, large and very healthy.

Benthamia fragifera. A beautiful fruit tree.

Bougainvillea glabra and *B. spectabilis.* "The glory of the Riviera."

Cacti. Very many kinds.

Camellia. Require very careful cultivation and shade.

Carica candamarcensis. A large plant in fruit at Mentone.

Casimiroa edulis; the Mexican Apple. A tree, perfectly healthy, at Mentone.

Catha edulis, Arabian Tea.

Ceratonia siliqua.—Very common, in fruit.

Chrysophyllum imperiale (Theophrasta); a large healthy specimen at Villa Valetta. This plant is invariably unhappy under cultivation; probably it dislikes a stove temperature all the year round.

Citrus trifoliata; used as a hedge plant, makes a strong fence.

Cyphomandra betacea, the Tree Tomata; an old plant covered with fruit in Mr. Hanbury's garden, and another at Monte Carlo, where it was labelled *Solanum Wallisii.*

Dammara robusta and *D. Brownii,* large trees 30 feet high.

Diospyros.—In the garden of the Acclimatisation Society at Hyères there is a series of trees of *Diospryos,* bearing the following names:—*D. costata, D. Lotus, D. Roxburghii, D. Mazelii,* and *D. Kaki.* These all appear to be forms of one species. I found the fruits offered for sale in Paris. The trees were in fruit at Hyères at the time of my visit, and were exceedingly handsome. They were about the same size as an ordinary apple tree, say, 10 feet high, and they bore hundreds of fruits somewhat resembling a large compressed tomato in size, form, and colour. The flavour of the fruit is rich, very sweet, but rather woody. If taken properly in hand a valuable fruit might be developed from them. The flavour wants slightly improving and that is all.

Doryanthes Palmeri, Hill.—Fine plants at Cannes, one of them showing flower.

Dracæna indivisa, D. Draco, and *D. australis* are of course plentiful all along the Riviera, the last named being as abundant as *Phœnix.*

Eriobotrya japonica.—One of the delights of the Riviera, very fragrant in early winter when it flowers. Cultivated for its fruits.

Eucalyptus; many species.

Ficus elastica, F. macrophylla, and *F. rubiginosa,* all large handsome trees.

Freycenetia Banksii; quite hardy at Cannes, where it has flowered.

Grevillea robusta; frequent as a large tree.

Greyia Sutherlandi.—A large plant in fine health at Cannes; it blossoms freely and regularly in March.

Hakea; some large healthy plants at Mentone; *H. eucalyptoides* in flower, was one of the most beautiful objects I have ever seen.

Jacaranda mimosæfolia; large healthy specimens in several gardens.

Jasminum grandiflorum.—One of the prettiest and most fragrant of Jasmines; largely cultivated and used in the manufacture of scent.

Magnolia grandiflora; very large trees, plentiful in gardens; the form with ferrugineous down on the under side of the leaves is called *M. ferruginea.* The fruit in autumn is almost as ornamental as the flowers.

Monstera deliciosa, not quite hardy on a lawn at Cannes, where it grows against a palm and fruits annually.

Musa sapientum and *M. Ensete,* all in good health, the last named flowering in Mr. Hanbury's garden.

Myoporum; several species planted in positions very near the sea.

Papyrus antiquorum, in positions sheltered from wind.

Persea gratissima; a large tree in Mr. Hanbury's garden.

Pilocarpus pennatifolius, the "Jaborandi," a large bush bearing flowers and fruit at Mentone.

Pittosporum, about a dozen species apparently naturalised in the Riviera.

Psidium Cattleyanum and *P. Guayava;* in fruit at the time of my visit.

Puya gigas, Andre.—A fine plant, perfectly happy in Mr. Hanbury's garden. This species produces a flower spike 30 feet high, and white flowers tinged with red and violet. It is in the Kew collection.

Rhododendron ; very poorly represented.

Russellia juncea ; a common garden plant, beautifully in flower in October.

Strelitzia augusta and *S. Reginæ*, both as fine as at the Cape or Madeira.

Trevesia sundaica and *T. sp.*—These two plants astonished me. They are both natives of Singapore, but at Cannes and Nice they were in perfect health, and had been so for years.

W. WATSON.